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[OFFICIAL NOTICE.]

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

The Annual Meeting of the Association will be held at Young's Hotel, Boston, on the 18th and 19th days of February, commencing at 10 o'clock, on Wednesday forenoon, February 18th.

Members intending to propose to the Association the names of applicants for membership are requested to send the same to the Secretary at least one day before the meeting.

The Directors will meet at the same place, on the evening of Feb. 17th, at 8 o'clock. Papers to be read before the Association should be forwarded to the Secretary, in season to be presented by him to the Directors at that meeting for their approval.

GEO. B. NEAL,
Secretary.

BOSTON, Jan. 24th, 1880.

GAS WORKS WITH DEFICIENT PLANT.

In another column will be found an interesting practical paper, read before the West of Scotland Association of Gas Managers, by Mr. R. S. Carlow, of Port-Glasgow.

The discussion on this paper was also not void of instruction, and brought out the main point to be borne in mind—viz., the great advantage resulting from having works fully up to the demands liable to be made upon them, not only in capacity but also in efficiency and economy. We are just emerging from a season of depression in general business which has been severely felt by many gas companies. During this time it has doubtless been deemed a wise policy, or perhaps a necessity, to restrict expenditures for improvements to a very small amount. Extensions have not been needed, and the works have been kept along as best they could. From all accounts that we can gather, a new outlook has presented itself, and the business of the past few months shows a decided improvement; and, in fact, there is every prospect of a revival of prosperity in which the gas interests of the country are bound to participate.

With this return of better times comes the stern, positive demand for gas at a lower price than formerly. In many places this demand has been already promptly met, and reductions have been made in the selling price. And whether attributable to the better times, or the lower price, or both, the result has been, in most cases, an increase of business.

But should the cost of materials advance, how is the lower price to be maintained, and a fair profit made upon the capital invested. Where the capital of the companies is larger than it should be, the first thing that *oughi* to be done is to reduce it. This is being done in a few cases, but we regret that we are unable to record more instances of it. When the capital is not excessive, the course to be pursued is a plain one also. Greater economy and more scientific proceedure in the manufacture, and a reduction in the expenses of distribution and collection are absolutely necessary.

In the extension or remodeling of works three points must be carefully studied—viz., the proper application of mechanical appliances for saving labor, a better method of heating benches, and increased attention to the saving and sale of residual products.

In one of the stations of the Paris Gas Company they sell eighty-five per cent. of the coke made—the benches being heated by regenerative furnaces. Here is a point where much may be gained. The market must be found created, if necessary, and supplied, and the returns will be astonishing. There is no reason why a pound of carbon in the form of coke is not worth as much, if not more, than a pound of carbon in the form of anthracite, if it be put into the same convenient shape, and the people taught how to use it. The same may be said of other residuals, Constant, unflinching, and persistent effort may be necessary to secure the proper sale of residuals; but, nevertheless, it will pay in the end, and the net cost of gas manufacture will be placed at a figure that will enable those selling it to compete successfully with every other source of light and heat for general domestic purposes.

Let plans be well matured, the best and most approved mechanical appliances used, manual labor reduced to a minimum, and the house will be put thoroughly in order, and the manager need fear the coming of no man.

The Waste of Energy in the Production of Water Gas.

NEWARK, NEW JERSEY, Jan. 27th, 1880.

Editor AMERICAN GAS LIGHT JOURNAL—

I have this day sent the following reply to "an open letter," written from Stockholm, Sweden, and published in one of your contemporaries as a so-called review of my article on "The Waste of Energy in the Production of Water Gas," which appeared in your JOURNAL of January 2d, 1880.

EUGENE VANDERPOOL.

Mr. Editor: I notice in your *Journal* of Jan. 20th the so-called review of my paper on the Waste of Energy in the Production of Water Gas, to which the attention of your readers was directed by your editorial of January 13th.

There are but two points reviewed worthy of attention. As the official data respecting these points have been heretofore submitted to the public by your reviewer, *and entirely confirm my position*, I briefly give them. First, as to the anthracite coal required to make 1000 cubic feet of water gas by the Lowe process.

Your reviewer refers to the practical results obtained at Phœnixville and Utica.

You will find, in a pamphlet entitled a "Communication on the Lowe Gas Process," p. 36, a letter to G. S. Dwight, Esq., by the Superintendent of the Phœnixville Gas Works, where the Lowe process had been in practical use more than two years—

"With ¼-ton of coal, and 64 gallons of oil, we have made 15,000 cubic feet."

The weight of a gallon of crude petroleum calculated from specific gravity ·878 (see Tables of Haswell, also, D. K. Clark) is 7·3 pounds.

Therefore, to produce 15,000 cubic feet of gas required $1120 \times 467 = 1587$ pounds of coal *and oil*, the weight required to produce 1000 cubic feet being $1587 \div 15{\cdot}000 = 105{\cdot}8$ pounds.

At Utica, page 29, same pamphlet, is given the work done in the month of September, which is the best month's work of the five months ending December 31st, the works being destroyed in January.

To make 3,050,600 cubic feet of gas required 203,035 pounds of coal, *and* 69,182 *pounds of oil*, 272,217 pounds in all, the weight required to produce 1000 cubic feet being $272{,}217 \div 3{,}050.600 = 89{\cdot}2$ pounds.

The more satisfactory figures, because covering a longer period of time, are the official ones of the Utica Gas Light Company, of the working of the Lowe process for the five months ending Dec. 31st, being—

Pounds of coal used	1,063,277
" oil used	368,231
Total	1,431,508

Lowe gas made, 15,225,500 cubic feet. Weight required to produce 1000 cubic feet equal $1{,}431{,}508 \div 15{,}225{\cdot}500 = 94{\cdot}03$ pounds.

More recent official statements of the Lowe process confirm these figures, viz.:

Six months ending March 31, 1878, at Trenton Gas Works; to produce 1000 cubic feet of gas were required 123 pounds of coal and oil; and at Toronto, for the seven months ending Sept. 30, 1879, were required, 98·49 lbs.

There are several elements wanting to absolutely determine from the above data the weight of coal required to make 1000 cubic feet of water gas (non-illuminating) by the Lowe process. Among them may be stated the *volume of the oil gas in the mixture*, the quantity of fuel (it has been asserted that none is required by the Lowe process) to decompose this oil, and the quantity of carbon from the oil that may assist in the decomposition of the water.

These elements are more or less determined in other methods of making illuminating water gas, but cannot be transferred from one process to another as the conditions under which the gas is made and carburetted are so different. Under no system of fair calculation can it be shown, from the practical results quoted above, that the water gas, *separated from the volume of oil gas*, was produced by an expenditure of less than 75 pounds of coal per thousand cubic feet.

So far as I know there are no authentic records of the production, in every day work, of 1000 cubic feet of pure water gas by an expenditure of less than 75 lbs. of anthracite coal. The possibilities in this direction are freely shown in my paper.

2d. As to the heating power of the water gas.

It is shown by your reviewer, in your *Journal*, of Aug. 20th, 1879, that one cubic foot of coal gas is equal to 2·20 cubic feet of water gas; and I am inclined to believe that, practically, the difference in favor of coal gas is still greater.

The commercial effect of this fact is so evident to the gas-maker that it need not be enlarged upon. I might also mention the point criticised as to my unfairness in estimating, on Oct. 9, 1879, that anthracite coal would probably advance in a few months to $4.50 per ton. By turning to your quotations in the very issue in which the review appears, I find that the anthracite coal used in water gas works is already $4.50 per ton alongside in New York. If the winter had not been so unusually open, it would unquestionably have been still higher.

I would say, in closing, that the largest water gas works in the world are in the city of New York, erected by one of the most competent and renowned mechanical engineers in this country, who is well versed in the construction and manipulation of coal gas works; this engineer has had the assistance of men of the highest scientific attainments, with unlimited capital to carry out his ingenious ideas, and the manufacture of the gas has been superintended by a most capable, energetic, and intelligent man. The official working results of this company for an entire year have just been made public. I would refer to them as a complete proof of the essential correctness of my estimates of cost. To which, with other matters, I would refer your readers as a complete vindication of my paper.

In conclusion, allow me to say that there are several misstatements in the review—some germane to the matter, and others not; but the remainder of it is entirely unworthy of notice. Indeed, were it not that some of your uninformed readers might be misled, I should have passed the whole of it unnoticed; as it is, I drop the matter here.

EUGENE VANDERPOOL.

NEWARK, N. J., Jan. 26, 1880.

Annual Review of the Petroleum Trade.

The petroleum business during the year just closed has been marked by many results never before attained. The enormous production of crude, (nearly 20,000,000 barrels), exceeded the production of any previous year by about 5,000,000 bbls. The average price of crude at the wells for the year was 94¾ cents per bbl., being 39¼ cts. less than for the year, which has been heretofore considered the "cheap oil year." The number of wells drilled during the year was 3,038, which number was not greatly in excess of former years, only about 6¼ per cent. of the wells completed proved to be dry or worthless, against 11¼ per cent. of dry holes developed in 1878. The shipments out of the producing regions have been larger than in any previous year, amounting to nearly 16,000,000 bbls., which exceeded the shipments of 1878 nearly 2¼ million bbls. The accumulation of stock in the producing regions of Pennsylvania during the year has been without a parallel in the history of the trade; the amount of stock January 1, 1879, was 4,615,299 bbls., and on January 1, 1880, 8,470,490 bbls., being an increase of 3,855,191 bbls. in 1879. The great Northern, or Bradford district, has contributed largely to these results; in fact for the last two years this field has been the chief point of interest in the oil country, where most of the operators have congregated and most of the developments have taken place. In the last five years there have been about 6000 wells drilled, 5,100 of which are now producing oil at about the rate of 45,000 bbls. per day. The total production in that district from August, 1875, to December 31, 1879, was 21,991,544 bbls. and the shipments out were 15,771,214 bbls., leaving a stock in tanks of about 6¼ millions of barrels. The exports of petroleum for the year have been unprecedentedly large, exceeding all former years by many million gallons. The stocks held in European ports are also quite large, exceeding the amount held at the same time in 1878 some 500,000 bbls.

The maximum production of crude petroleum in the Pennsylvania oil fields was reached in August, 1879, since that time the production has undoubtedly been steadily on the decline, and from present indications we may look for a continued decline, slowly but surely, until some new and now unknown field shall be found which shall yield the precious fluid bountifully.

There was a steady increase of stock at the wells during the first eight months of the year, which was not reported, and did not go into the account in making up productions and stocks. The pipe lines prior to September did not take from the wells their production which was evident from the overflowing tanks everywhere to be seen in the Bradford district. Since the month of August the wells have not only been relieved but the lines have been taking all the production and steadily drawing on the well stock. The month of December shows that the stock at the wells has been depleted about 182,250 barrels which we have credited to productions and stock by distributing 750 barrels a day through the first eight months of the year.—*Stowell's Petroleum Reporter.*

ENGINEERS' CLUB OF PHILADELPHIA, PA.—The second annual meeting of the Club was held on Saturday evening, Jan. 10th, and in the absence of Thos. C. Clarke, President, the chair was occupied by Prof. L. M. Haupt, Past President. There were present 27 members.

The following gentlemen were elected officers of the club for 1880: President, Frederick Graff; Vice-Pres., Percival Roberts, Jr.; Rec. Sec., Wilfred Lewis; Cor. Sec. and Treas., Chas. E. Billin; Board of Directors, Rudolph Hering, J. Coleman Sellers, Jr., Howard Murphy, Geo. Burnham.

[From the London "Journal of Gas Lighting."]

Midland Association of Gas Managers.

At a meeting of the above Association, held at Birmingham, October 18, 1879, the President called upon Mr. Winstanley and Mr. Peaty for a description of "Hislop's Patent Process for the Revivification of Spent Lime."

Mr. H. Peaty (Longport) said that, owing to a great press of business, sufficient time had not been given to the paper. A few notes had, however, been prepared, which might be enough to introduce the subject. They were as follows:

REPORT ON HISLOP'S PATENT FOR CONVERTING THE SPENT LIME OF GAS WORKS INTO QUICK LIME.

In June last Mr. Winstanley and myself paid a visit to the gas works at Paisley, to examine Mr. Hislop's method of converting the spent lime of gas works into quick lime. We propose to give a brief description of the process and our opinion of its merits.

The kilns used were in one of the retort houses, part of the retort bench being adapted for the chambers. The whole arrangement consists of a series of four chambers set one above another, heated by a furnace underneath. In the uppermost chamber, which is called the drying chamber, the charge of foul lime, consisting of about 15 cwt., is placed, and remains there till red hot, and consequently all moisture is expelled. When ready, this charge is delivered into the chambers below, through an opening in the floor of the upper, the charge being equally divided between the chambers underneath. These, with their contents, are kept at a white heat for six hours, the lime being stirred three times during this period. The lids are then taken off and the charge drawn into an iron barrow, precisely as a charge of coke from a gas retort. The quick lime appears as a light brown powder, which turns white when treated with water, and it then appears as the ordinary hydrate of lime.

The shape of the chambers is that of a large flat D retort, having an opening near the end to allow the furnace gases to pass over and through the lime the whole length of the retorts, finally passing into the drying chamber above, and through the flue into the chimney. This method effectually changes the sulphide of lime into carbonate of lime, till the intense heat converts it into quick lime.

Mr. Hislop is now using lime which has been restored upward of a hundred times, and claims that the lime thus restored is as effectual as when first used.

Having ascertained that the work is complete, we will consider it from a financial point of view. The cost of erection of two sets of chambers with their furnaces is about £75 or £80—we will say £80. Mr. Hislop's experience is that 700 to 800 tons of lime can be produced before renewal of portions of the chambers, and 2000 before the whole requires resetting and renewing. In works using 400 tons of lime per year, partial renewal will be required every two years, and reconstruction every five years, besides wear and tear of furnaces. Interest on outlay at 10 per cent. per annum will be £8. Wear and tear and reconstruction when worn out, say, £20 per annum. The charge per ton of lime used will therefore be 1s. 5d. One man at 4s. per day can produce a ton of lime a day; and the cost of coke for each ton will be 1s. 6d. The cost of royalty is 7s. 6d. per million cubic feet of gas produced. The quantity of gas purified by one ton of lime varies very much in different works, but, estimating that three tons of lime purify a million cubic feet of gas, we have a royalty charge on each ton of lime of 2s. 6d.

To recapitulate: The charge is, on each ton of lime, for—

Interest and renewal	1s. 5d.
Labor	4 0
Coke	1 6
Royalty	2 6
	9s. 5d.

It is evident that each of these items will vary according to circumstances. Where but little lime is required the charges for interest and renewal will be higher. Where a small quantity of lime is used in proportion to the make, the charge for royalty will be higher. Where coke is high in price the charge for firing will be proportionally high.

Mr. Hislop calculates that the cost of renewal on his works is about 3s. per ton, and as he cannot obtain fresh lime under 16s. per ton, a saving of 8s. per ton is effected.

No mention has been made at present of any alternative method of disposing of the spent lime. We know some can sell this refuse for 2s. 6d., 3s., or even 4s. per ton; others have to cart it away themselves, so that in large works, and away from easy reach of the farmers, it is a serious consideration how to deal with it.

Mr. G. Livesey, in a paper read before the British Association of Gas Managers in 1876, has this passage: "Supposing the whole of the London gas companies included in the act of 1860 to be compelled to deal with the sulphur compounds according to the referees' requirements, and supposing further that the quantity of lime used at Bow Common to be taken as the basis of the calculation—viz., 17 tons of coal to one yard of unslaked lime, which increases to about two yards of foul lime, we find that after purifying the gas from 1,500,000 tons of coal—the quantity used in 1875—there will be some 160,000 yards of foul lime to be disposed of, sufficient to cover an area of 34 acres one yard deep. What is to be done with it?"

Yes, that is the question. Some sell it at a profit; some grind it up with ashes and sell it as mortar, or use it as luting; some, as in my case, have to give it away; others, more unfortunate, pay to have it removed.

In conclusion, we think that the process is a most valuable one, and in many places would be a great step in economical working, without noticing prominently the undeniable advantage of having the supply of lime in the managers own hands.

(Signed) H. PEATY.

Mr. Paterson inquired as to the possibility of a nuisance arising from the reburning of the lime, remarking that this became a vital question in many towns, especially fashionable watering places. A great deal of security against nuisance would depend upon the extent to which the lime was carbonated before being reburnt. He could easily see that if a little sulphide was left in the lime there would be no chance of nuisance in reburning it.

Mr. Stevenson asked if it were not the fact that the ovens were situated in the retort house. If so, and the emanations from the ovens were taken out with other fumes from the retort chimneys, they would be converted into sulphurous acid, and would be very little nuisance.

Mr. Woodall said if 20 per cent. of the retort house was taken up in the carrying out of the process, then 20 per cent. of the cost of the land and buildings must be taken into account in estimating the cost of adopting the process.

The President asked if he correctly gathered that a ton of the revivified lime went as far as a ton of the original lime.

Mr. Peaty replied that Mr. Hislop stated that it did, but he (Mr. Peaty) had no means of judging, except from the printed report.

Mr. Tindall inquired if all the sulphur that was taken up by the lime was lost.

Mr. Peaty, replying to the various questions, said when he and Mr. Winstanley were at Paisley they did not notice any particular nuisance. The lime appeared to be very much carbonated. He saw little sulphide of lime in that which was being manipulated. It was dealt with by taking the fumes away by the blast out of the chimney. In the same way he was dealing with sulphuretted hydrogen produced in the manufacture of sulphate of ammonia at the works with which he was connected.

Mr. Paterson—That is sufficient to create a nuisance.

Mr. Peaty said every large chimney must be a nuisance more or less, but he had had no complaint. As to the cost, four tons make in a day and night, or about 1400 tons a year, would need very small plant. If not placed in the retort house, it might be put near the engine house stack, in such a position as that a connection might be made. The sulphur would be entirely lost, no means having been discovered of keeping it.

[From London "Journal of Gas Lighting."]

West of Scotland Association of Gas Managers

At a meeting of the above Association Mr. R. S. Carlow (Port Glasgow) read a paper as follows, on

THE DISADVANTAGES OF MANUFACTURING AND SUPPLYING GAS WITH DEFICIENT PLANT.

You will see that I have been put down on the programme to read to you a paper on the "Disadvantages of Manufacturing and Supplying Gas with Deficient Plant." The subject is not one of my own choosing, for it was suggested to me by one of your number some time ago that, as the works which are under my care had been recently rearranged and remodeled, I might be able to speak (1) on the disadvantages a gas manager has to contend with when he is working with plant totally inadequate to the requirements of his place; and (2) the great benefit that follows from having the best appliances that can be obtained, and the works put in the most efficient state for working. When this was suggested to me by our friend, I said that I might be able to say a few words on such a subject, and if you will kindly bear with me for a little, I will endeavor to describe to you the state of the Port Glasgow gas works both before as well as after the late alterations. I think it is much better to confine myself to a short account of the works rather than treat in the abstract the subject which has been given me. It is, I think, self-evident that with deficient plant a gas mana-

ger must labor under many and great disadvantages in manufacturing and supplying gas, and of course it should be the aim of every one of us to inquire into and study what improved appliances can be used, and what are the best arrangements that can be made so as to get the best possible results out of our works.

The Port Glasgow gas works, previous to the year 1874, were in a most defective state. In point of fact, they had become totally inadequate to supply the growing requirements of the place, and it was a question with the town council whether it would not be better to abandon their own works altogether, rather than incur the large expense of putting them in working order, and take a supply of gas for the town from their Greenock neighbors. It was finally resolved to alter and extend their own works, and put them into such a state of efficiency as would meet the altered requirements of the place. But before I describe the alterations and improvements that were carried out, a few words on the condition of the old works will be necessary.

First, as to retorts. The number of retorts in the works prior to 1874 was 17. I have nothing to say against the retorts themselves, but the benches were in a most dilapidated and insecure condition. The manufacture, both per mouthpiece and per ton of coal, was very small, in consequence of the limited capacity of holder room, the total amount being only 45,000 cubic feet, while the maximum daily make was 100,000 cubic feet. Constant charging was a thing quite out of the question in the works, one-half of the retorts in use having to be hung during part of the night, after eleven o'clock. All the retorts were again charged between five and eight o'clock A.M., and this having been done, recourse to hanging had again to be taken until evening, when lighting commenced. I need scarcely add that with so much hanging, the retorts were never tight, and the amount of gas lost was considerable and incalculable. I have no actual statistics to show the exact amount of gas lost in this way, as the station meter then in use was not working satisfactorily, in consequence of the defective state of other plant of which I will afterward speak. The loss was also considerable through having little coal storage; and often coal very wet, as it came from the trucks, had to be charged.

The condenser was one of the common kind, the chest being only about 9 feet long by 2 feet broad, with sixteen 8-inch pipes, eight pipes in a row. This condenser was quite insufficient for the work it had to perform, as large quantities of tar and liquor passed right through, and lodged in the bottom of the small purifiers then in use. The temperature of the gas was not much reduced after passing through the condenser, and it had a brown, smoky appearance, and on holding a white paper to a small hole at the outlet of the condenser, the tar and liquor deposited themselves quite freely thereon.

There was one of those small old-fashioned washers, placed at the end of the condenser; but, this, instead of doing any good in freeing the gas of ammonia, as it should and was intended to do, rather acted as an agent for contributing back pressure upon the hydraulic main.

There were four purifiers in number, 6 feet square and 4 feet deep. These also were far too small, and served more for the purpose of condensing the gas, and depositing the tar and liquor, than for any amount of purification that took place. The inlet pipe entered at the centre of the bottom of the purifier, and came right up to the top. The gas had thus to force its way down to the bottom before leaving the purifiers. I consider this course to have been against the purification of the gas, for the reason that when little condensation or washing took place the tar and liquor which should have been left in the condenser or scrubber lodged upon the top trays of the purifiers above the lime, and made the lime quite stiff and hard, more like a layer of Caithness pavement than lime. Four rows of sieves were in each purifier, and each sieve was alike in hardness. This stiffness in the lime caused a great back pressure upon the retorts. I have seen it as high as 10 or 12 inches, and the purifiers all blowing at the lutes. It was a nightly occurrence to see the purifiers all blowing, and a fine job it was sometimes before they settled down—running off condensed tar and liquor from the pipes in connection with the eight-way valve, and turning each of the purifiers off and on until it was ascertained in which one of them the choke was, and after it was discovered, emptying and refilling it as soon as possible, and doing every conceivable thing that could be thought of to try and get over the difficulty. Complaint of bad gas was a general thing in the town; in fact, some of the employees in one of the largest manufactories in the town had on several occasions to leave the place they were working in, the smell of sulphuretted hydrogen from the gas being so intolerable. I had two purifiers changed each day for three days prior to one of these complaints being made, and I was at a loss to understand how the gas was getting past the purifiers in this condition. In order to find out the cause, I stationed one of the men at the inlet valve of the holder that was filling at the time, and told him to shut the valve at once, and thus cause the back pressure of the gas to act upon the lime in the purifiers. Upon lifting the lids of the purifiers, it was found that the lime was all in cakes, and broken and lying in all directions. The action of the uncondensed gas had deposited tar and liquor upon the top of the lime, and had, when the lime was of a certain stiffness or hardness, made ruts for itself and passed through these ruts into the outlet of the purifiers, thence into the holder in an unpurified condition; and, of course, the consumers were supplied with it in this state. Besides all these drawbacks, the cost for lime and labor was enormous. For purifying thirteen million feet of gas it cost £50 for lime, and even then the gas was not half purified, and a man had to be kept in the purifying house nearly all the year round, besides extra time on many occasions when purifiers had to be changed in the dark.

Prior to 1874 there were three gasholders in use, of the following capacities: One of 30,000 feet, one of 9000 feet, and one of 6000 feet, giving in all a storage of 45,000 feet, while the maximum daily make was 100,000 feet. You will thus have an idea of the disadvantage it was to supply the gas in anything like a state that would give satisfaction to the consumers. When it came to ten o'clock at night, it was a common occurrence for both the manager and stoker to be standing anxiously watching the holders, expecting to see them go out of sight, and reducing the pressure to the town bit by bit until actually it could not be with safety reduced any more, and I can assure you it was a relief indeed when we found that instead of losing we had gained a little, and the holder was beginning to make its way up again.

Great as the difficulties were we had to contend with on account of the small holder room at our disposal, we had a still heavier trial to meet, for when the laborers were excavating for building a large new tank, the side of the old tank gave way at the foundation, and fell into the excavation of the new one. When this took place we were left with only the 9000 and 6000 feet holders, to work with, in supplying gas to the town—and bear in mind the delivery was upward (it being the month of January) of 100,000 feet per day. There was no outlet of the 6000 feet holder to the town, and consequently we had to make this light holder heavier than the larger one, which was done by putting a quantity of fire-bricks round the rim of the holder on the top of the angle-iron. By this means we were able to draw the gas from the small holder through the inlet pipes into the larger holder, and then send it on through the pipes into the town. Some of you will think that it was scarcely possible to supply 100,000 feet of gas a day with only 15,000 feet of holder capacity, but I can assure you it had to be done, and this was surely supplying gas with deficient plant at an enormous disadvantage.

It may be interesting for you to know how I managed under the difficulty in which I was placed. The morning I was called from my bed and told what had occurred, I can assure you I felt it to be a fine position to find myself in. There was little time to think, so I gave the order to handle six retorts of the new bench, which had fortunately by that time been erected, and had them ready for charging before four o'clock in the afternoon, which I did with Lesmahagow main seam coal, and with a double shift of men the retorts were kept going, and the town was supplied with gas as usual, although at a low pressure. The loss, of course, in working in this way must have been very great indeed, and to give you an idea of it would be impossible.

One of the great disadvantages a manager has to contend with is working with deficient accommodation in holder room, for if the men are not very careful in charging the retorts with the proper quantity to fill the holder, or if by a sudden stroke of sunshine the holder expands, it will get too full, and commence to blow, when you must either let it blow on, which causes a very bad smell, especially from an old holder, or you must pull the plug of the purifiers, or slack the lids of the retorts; and in either of these cases you are bound to lose a very considerable quantity of gas, besides incurring a large amount of danger.

I have thus shortly described the state of the old works at Port Glasgow, and endeavored to show you some of the disadvantages of manufacturing and supplying gas with the deficient plant then in use. I cannot tell you exactly what it cost to manufacture and supply gas under the old process, as I have no reliable statistics at hand to show this; but it must have been very great proportionately to what it costs now with our new and improved machinery.

I would just ask your attention for a little longer while I describe some of the improvements which have been carried out at the works.

In the first place I may state that the retort house and coal store have been extended, and are now embraced under one roof. The span of the roof is 74 feet, and the length is 125 feet. The men do not require to go into the open air for the coal, which is a very great advantage indeed. About 1000 tons of coal can easily be stored in the coal store, and the coal can be thoroughly dried and put in a proper state for carbonizing before it is charged.

A new double bench of 24 retorts (12 on each side) has been erected in the centre of the building, and this bench can be easily extended should the requirements of the place call for it. The make per mouthpiece at present

(working shale and splint parrot, half and half) is 6500 feet, or, as near as I can calculate, 8300 feet per ton. The average illuminating power is 27 candles; and the durability of 1 cubic foot of gas with a 5-inch flame is 57 minutes—results which may, I think, be considered satisfactory.

A large condenser has been erected with forty 12-inch diameter pipes (twenty on each side), with a large bottom chest. The condenser is capable of doing three times more work than is at present required of it. The temperature of the gas during the winter months stands at nearly 90° when it enters the condenser, and last winter I have seen it leave at 47° and 48°. I may state here that a steam pipe has been led into the condenser at several places, by means of whick it can be thoroughly cleaned at any time. This I consides a very good arrangement, and one I would strongly recommend, as during the time the steam is being injected into the condenser the illuminating power of the gas is increased. Of course care must be taken that the introduction of the steam be not continued for too long a period, otherwise the gas will be impoverished.

Two large scrubbers have been erected, each 16 feet high by 7 feet square, with a division in the centre of each. Three rows of perforated cast iron plates are placed at certain distances in each scrubber, and these plates I am in the habit of keeping covered with a layer of heather. The scrubbers are more than sufficient for the present requirements of the works—in point of fact, they are capable of doing three times the amount of work they have to do at present. When these scrubbers were first erected, two new pumps to work in connection with them were placed rgainst the inside wall of the exhauster house, and were driven with a belt from the exhauster engine; but this arrangement was afterward found not to work well. The pumps were eventually removed, and a new engine was erected immediately alongside of the scrubbers, for the purpose of working the scrubber pumps and a pump for lifting the tar and liquor from the wells. When I state that in 1873, when the works were in a very inefficient state, the amount received for tar and liquor was only £63, with a make of nearly 14 million feet of gas, you will see that we are getting very good results now with our new scrubber and condenser, for in 1877, with a make of 19 million feet of gas, the amount received was over £300. This sum was what was received when we were working with the small pumps which I have just referred to, but after the new engine and larger pumps were erected we had better results, for within a twelvemonth an extra £100 was obtained on the tar account, and we had even a less make that year than in the one immediately preceding. The engine and pumps cost only £110, so that they have at all events paid for themselves, and you will see that great saving and economy have been effected through their use. Wherever such an engine and pumps can be used, I would stronly recommend them, as I consider the proper extraction of ammonia from the gas to be one of the matters to which a gas manager should direct his most careful attention, and when this is properly attended to a considerable addition is made to the revenue of his works.

A new exhauster has been erected, and I consider this a most valuable machine, as by means of it a large quantity of gas that would otherwise be lost is drawn through and sent on to the station meter for registration. Whenever retorts are porous and leaky, or joints defective, the exhauster has the power of drawing the gas gently past the defective place, where it would otherwise be lost, and passing it, as I have just said, on to the station meter. Perhaps I should state that I am in the habit of working this machine so as to have the pressure as near zero as possible, and when I allow it to be thrown out of gear I have in no part of the works more than 4 inches of back pressure.

Three new purifiers have been erected in the works, each of them 14 feet square, and they hold about 6 tons 10 cwt. of slaked lime; four rows of sieves are on each of the purifiers, and each of the sieves has on it an averages of 6 inches of lime. It is a thing of the past to have a choke in the purifiers, or to have any of them blowing. It is a pleasure to work them. One purifier only requires to be changed in a fortnight in the dead of winter, and one man can empty and fill it in a day. The total cost for purifying 19 million cubic feet of gas is now £96; and six weeks of a man's time in a year will change all the purifiers I have to change.

The present capacity of the holder in the works is 160,000 feet, and one of them has been left so that it can easily be make into a telescopic holder, which will give increased holder capacity at very little extra cost. I have now never any cause for hanging retorts, and when the charging is done it is always done regularly and at the proper hours.

Formerly there was no governor in the works, but a good one has now been erected, and a given pressure can always be maintained, and a saving of gas by this means effected.

The station meter at present in the works is the old one that was formerly used, but it has been put in thorough repair, and is now doing its work well.

I have said nothing as to the state of the outside plant. This department of the works has only recently come under my care. It is not, I am sorry to say, in a satisfactory condition, a great numbhr of the meters, and also main and service pipes, being very defective; but the commissioners have given orders for the thorough overhauling of the outside plant. The work has already been commenced, and is being prosecuted by degrees. I hope that in the course of another year the outside works will be in as good and as satisfactory a condition as the inside works now are.

In conclusion, gentlemen, I have endeavored to show you the state the Port Glasgor gas works were in prior to 1874, and the great disadvantages that had to be contended with in manufacturing and supplying gas at that date with the deficient plant at my disposal. I have also tried to give you an idea of the alterations and appliances that have been added to the works, and the great facilities we now possess as compared with the former times; and I hope the reading of my paper will be of use to some of the members present. It is, I am well aware, far from being a perfect production, but I am sure its demerits will be gently treated at your hands.

DISCUSSION.

Mr. Fullerton (Motherwell) asked how many retorts Mr. Carlow had in use between six and ten o'clock in the evening when he had to supply 100,000 cubic feet of gas a day.

Mr. Carlow said there were 17 in all.

The President said that he was almost in a similar position to that in which Mr. Carlow was placed last winter. He had 80,000 feet of storage, and required 240,000 feet of gas in 24 hours. Things had now improved with Mr. Carlow as well as with himself, and they could both look forward to dark weather with the satisfaction that if all went well they would be able to meet the demand for gas. He thought a vote of thanks should be awarded to Mr. Carlow for his paper. There were many points in it which might escape observation on its first reading.

Mr. McGilchrist (Dumbarton) said he was pleased to have heard Mr. Carlow's paper. Mr. Carlow had presented a vivid picture of his old works and the difficulties he had experienced, and he had in equally vivid language described the excellent condition of his new works. One thing he had omitted which might advantageously have been included—namely, the cost per 1000 feet of gas made under the disadvantageous system, compared with the cost of production in his new and extended works.

Mr. Carlow said he could not give such an account, because he had often to borrow and call in additional laborers, and the additional expense was charged to capital account; besides a certain amount of gas went up the chimney, in consequence of the retorts being defective.

Mr. Niven (Dunoon) questioned the propriety of giving the information Mr. McGilchrist asked for, even if it had been possible.

Mr. McGilchrist said that the information he desired would have been of great value, because he knew many directors who would not give their managers plant when it was applied for; also many works where, until quite recently, there never had been a station meter or a governor. If they could show the benefits resulting from improving dilapidated works, it would give directors something like an idea of the loss sustained through working with deficient plant.

Mr. Brodie (Paisley) said he had something to do with the Port Glasgow works, and knew the predicament in which Mr. Carlow was placed. There was something in Mr. McGilchrist's question which was to the point. He thought the nature of the paper was to make a comparison between dilapidated works and works which had been remodeled, and the information desired by Mr. McGilchrist would have proved very valuable.

The President said, with respect to the cost, he might mention that in his old works, with imperfect washing and scrubbing power, and a too small purifying area, the purification of gas in the month of December cost about 3d. per 1000 feet, while just then he was purifying in new works for less than ½d. per 1000 feet. This showed the advantage of a large area for purification.

Mr. Watson (Stirling) said he could corroborate that statement. A scrubber would pay for itself in two years.

Mr, Carlow said he was much pleased with the way in which his paper had been received. It was his first production, and he trusted he might be able to read another paper at a future meeting. He might not in this paper have given the amount of information desired by the members, but could take up one subject specially at another time, and try to give some figures, which would be better than a history of the works at Port Glasgow.

A Big Lump of Coal.—The New York and Cleveland Gas Coal Company exhibits at the Pittsburgh Exhibition a lump of coal that weighs 9000 pounds and contains 118 bushels. It is from one of their mines at Plum creek, and it is claimed to be the largest lump of soft coal ever mined.

An Irishman's Gas Meter.—An Irishman of a mechanical turn took off his gas meter to repair it himself, and put it on again upside down. At the end of the quarter it was proved that the company owed him £3 7s. 6d.

[From the "Journal of the American Chemical Society."]

Petroleum and Its Examination.

By A. Bourgougnon.

In this communication to the American Chemical Society, I will describe the mode of examination which I have adopted in examining the different kinds of petroleum and its products. This method of analysis is the result of several year's experiments.

Before entering directly upon my subject, I think that a brief description of the general process employed in obtaining crude oil will be acceptable, and I will therefore relate some observations made during a recent trip through the oil-bearing territory.

I here take occasion to tender my thanks to Mr. J. Labouret, for his valuable information, and to A. J. Pouch, Esq., of the firm of A. J. Bostwick & Co., who has favored me with several samples very useful in my investigations.

Petroleum is found in several parts of the world, but the most abundant field of production is situated in Pennsylvania. It is also met with in several other States of the Union, but the Pennsylvania oil is justly considered the best in quality for illuminating purposes.

Contrarily to the rule governing the occurrence of most mineral substances, which are confined to well determined geological formations, petroleum occurs in rocks of nearly all ages, from the Lower Silurian up; most abundantly in shales and sandstones; also, to some extent, in limestones. In the Rangoon and Caspian regions the oil occurs near the surface in clayey soil, and collects in shallow pits. A noted locality in Ye-nan-gyoung, in Burmah, where the wells are narrow shafts 180 to 300 feet deep, and large enough for a man to work in. In Persia, the oil is largely found at Baku, on the west shore of the Caspian; China yields a small amount of oil; Japan has small and undeveloped districts; New Zealand also shows indications. In the Caucasus, Russia, surface wells have long been worked, and lately wells have been sunk with success. In Gallicia, Austria, are wells yielding largely; and Alsace and Hanover have produced some oil. Petroleum has likewise been found in Peru, Ecuador, Southern Mexico, San Domingo, Trinidad, and Nova Scotia, in small quantities. In Canada petroleum occurs mainly in the corniferous limestone of the Lower Devonian, but it is also found in greater or less quantity in the bird's-eye limestone of the Lower Silurian and the Lower Helderberg limestone of the Upper Silurian.

In the United States, oil is very abundant in Western Pennsylvania, and has been found in considerable quantity in West Virginia, Ohio, Kentucky, and Tennessee. It has also been found in New York State, in Michigan, Indiana, Colorado, and California. The oil of Southern California comes from tertiary shales. The upper oil region of Pennsylvania begins in the vicinity of Tidioute, on the Alleghany, in Warren Co., and runs southwest of Titusville, thence nearly south, along Oil Creek, into Venango Co., to Oil City, and thence southwest to Franklin.

The lower oil belt begins at Triangle City, Beaver Creek, Clarion Co., and runs southwest twenty-one miles to St. Joe, in Butler Co. In 1866 rock with some oil was struck at Brady's Bend, at a depth of 1100 feet, giving rise to further investigation of the river above, which resulted in the discovery of a sand rock of 57 feet in thickness, at a depth of 960 feet, on the Alleghany River at Parker's Landing. The oil-bearing rock of Pennsylvania is a sand-rock, of which different strata are struck at different depths.

Various opinions have been advanced upon the origin of the formation of petroleum. It was almost generally admitted that petroleum was derived from vegetable or animal matter. Another explanation was that petroleum was of a similar formation to coal, but under a different condensation. Among the more recent explanations upon the formation of petroleum, it has been suggested that this hydrocarbon was produced by natural distillation of coals and bituminous shales. Lesquereux attributes its origin to the partial decomposition of low form of marine vegetation, while Berthelot has advanced the theory that by complex chemical changes at present taking place in the interior of the earth, petroleum is being continually set free.

Petroleum has been known for ages. The spring of Zante, one of the Ionian Islands, was mentioned by Herodotus more than two thousand years ago; and Pliny says that the oil of a spring at Agrigentum, Sicily, was used in lamps. The city of Genoa was formerly lighted from the wells of Amiano, in Parma, Italy.

Prof. E. A. Foote (*Am. Chem.*, Nov., 1872,) states that Peter Kahn, in his "Travels in North America," published in 1772, gives a map of the Pennsylvania oil springs in 1771; but, according to H. E. Wringley, the earliest mention of petroleum in that State occurred in the report of the commander of Fort Duquesne, 1750, when he witnessed the ceremonies of the Seneca Indians on oil Creek. A prominent feature of the ceremonies was the burning of the oil as it oozed from the ground.

In 1819 Dr. S. P. Hildreth, in the *American Journal of Science*, alluded to the discovery of petroleum in Ohio, on the little Muskingum River, and wrote: "It is beginning to be in demand for lamps in workshops and manufactories. It affords a clear, bright light when burnt in this way, and will be a valuable article for lighting the street lamps in the future cities of Ohio."

The oil spring of Cuba, Alleghany Co., N. Y., called the Seneca Oil Spring, was described by B. Silliman, in 1833, as a dirty pool, about 18 feet in diameter, covered with a film of oil which was skimmed off from time to time for medicinal purposes.

In 1854 the Rock Oil Company was formed, for the purpose of gathering oil in the vicinity of Oil Creek. The process employed by this company was to collect all the surface oil they could by means of cloths, which were subsequently squeezed into tanks. In 1858 Col. E. L. Drake, the superintendent of the Rock Oil Co., conceived the idea of boring an artesian well near Oil Creek. After several experiments conducted with the persistency and enthusiasm of discoverers, he at last, in 1859, struck oil. A wild excitement prevailed throughout the country, and almost everybody was stricken with the "oil fever;" companies were formed to bore for petroleum, and in New York alone 317 of these companies were formed, representing a capital of more than $200,000,000.

Petroleum is extracted from bored wells of a variable depth, and about 7 inches diameter. Wells can be classified as follows: Flowing wells, pumping wells, gas wells, salt water wells, and dry holes.

The commercial history of petroleum begins with the Drake well, bored in 1859, near Titusville. At a depth of 60 feet only, oil was struck, and the daily production was 25 barrels.

The first flowing well was situated on the McEllenny or Funk farm. Oil flowed in June, 1861, at the rate of 250 barrels a day for fifteen months, and then stopped. Other flowing wells were bored, and among them the following are remembered: The Phillips well, on the Tar farm, with a daily production of 2000 barrels; the Empire well, daily production 4000 barrels for nearly a year, and then dropped to a pumping well, yielding 100 barrels a day; the Sherman well flowed 1500 barrels daily for several months, when it declined to 700 barrels, and continued flowing for twenty-three months; the Coquette, well known as the "glory of the oil regions," manifested a surprising peculiarity—after flowing 600 barrels a day for several months, it suddenly increased its yield with great rapidity, and reached 2000 barrels per day.

Flowing wells like the above are not now to be found through the oil region, but intermittent wells are sometimes bored. They flow at regular intervals, between which they are pumped.

Pumping wells are worked by steam engines, and the crude oil is received in wooden tanks. When this tank is full it is gauged, and its contents are transferred by means of iron pipes into large iron tanks. These large tanks are the property of the pipe companies, who buy all the production of the country. From their tanks the pipe companies send their oil to their station on the railroads through iron pipes, 2 or 3 inches in diameter, and from these stations petroleum is delivered into cars of a cylindrical form, holding about 85 barrels.

Throughout the oil district 42 gallons are evuivalent to 1 barrel, but the pipe companies take 43 gallons to the barrel, this extra gallon covering their charges for removing the oil from the tanks of the producer into their own.

The market oil delivered for a cargo is therefore not produced from a single well, but is the production of a whole district. Before the establishment of the pipe companies, the producers were obliged to send the oil to the railroad stations; now they are relieved of their trouble, since the pipe companies take oil directly from their wells, and pay for it prices fixed at the Petroleum Exchanges. Wells are bored by contract for so much a foot, but there is no external indication to prefer one place to another, although experiment has shown that the petroliferous zone fellows a line having an inclination of 22° north to south. This indication is not always correct, since producing wells have been bored out of the 22° line, some times as far as 16° inclination, and other wells bored in the neighborhood, or even upon the 22° degree line, have proved to be dry holes. The yield of a well decreases sometimes very rapidly, and the general belief is that the well is obstructed by solid hydrocarbons, such as parffine.

In order to remove this obstruction, a torpedo of dynamite is generally exploded in the well, which is intended to break the walls of the natural petroleum reservoir, thus connecting the shaft with it. The cost of such a torpedo is very high, and some producers try to dissolve the solid hydrocarbons by means of benzine. About 50 barrels of benzine are poured into the well, and after the lapse of twelve hours they are removed by pumping. In several instances the benzine only dissolved paraffine, and the produce pumped as crude oil was merely a solution of paraffine in benzine. The use

of the torpedo is not always followed by success. I was shown a well at Summit, the daily production of which was 60 barrels, but its owner not being satisfied (a neighboring well yielding 100 barrels daily), resolved to have a torpedo exploded in his well. The result was that the daily production was reduced to 16 barrels. The average depth of producing wells is about 1200 feet, and petroleum is designated under the name of third or fourth sand, according to the stratum where it comes from. This denomination is derived from the fact that before reaching the rocks bearing oil, the following layers are to be bored: 1st, the earth surface; 2d, first layers of slate rock; 3d, first sand rock; 4th, second slate rock; 5th, second sand rock; 6th, third slate rock; 7th, third sand rock; 8th, fourth slate rock; 9th, fourth sand rock.

The color of the third sand oil is darker than that of the fourth, and the specific gravity heavier by about one degree Baumé. At Butler, crude oil is amber colored, and comes from the fourth sand. The cost of a derrick and the boring of a well is about $1200.

In these last years the oil known under the name of Parker's oil has been in general demand abroad, as furnishing, when refined, as beiter quality burning oil than other crude oils. The fact, however, is, that other oils may yield just as good products as Parker's oil, but their treatment is more expensive.

It is estimated that the Parker district covers about 750 square miles.

Parker's oil is pumped to the following stations:

Harrisville, Fullerton Station, Foxburg Station, Parker Station, Monterey Station, Sarah Furnace, Brady's Bend, Sligo.

Parker's oil is generally clear. At Butler it is amber colored, but the color is darker a Millerstown; darker yet in Petrolia, Karns, and Parker; and the oil from Foxburgh has no longer the reddish tinge of the oil from the above-mentioned localities.

Although the denomination of Parker's Landing oil is generally adopted, we must remark that in the Revised Rules of the New York Produce Exchange the word Parker does not appear; it is, however, understood that when a contract calls for Parker's oil, the oil delivered must be of the first quality.

The examination of American petroleum by Pelouze and Cahours has established the existence of a series of hydrocarbons homologous to marsh gas. All these hydrocarbons are acted upon by chlorine, which produces a successive elimination of hydrogen, under the form of hydrochloric acid, and the substitution of an equivalent quantity of chlorine. The first term then of the substitution for each of these hydrocarbons is represented by the chlorhydric ether of the corresponding alcohol. All these chlorhydric ethers, heated with sodium, give sodium chloride and a hydrocarbon, containing two atoms less of hydrogen than the primitive hydrocarbon, thus converting the original marsh gas series into the corresponding olefines. The hydrocarbons isolated and studied by Pelouze and Cahours are the following:

Hydrocarbons.	Formula.	Boiling Point.	Specific Gravity.	
			Liquid.	Vapor.
		Degrees.		
Butyl hydride.....	C_4H_{10}	0C.	0.600	.....
Amyl "	C_5H_{12}	30	0.628	2.557
Caproyl "	C_6H_{14}	68	0.669	3.055
Oenanthyl "	C_7H_{16}	92-94	0.693	3.600
Capryl "	C_8H_{18}	116-118	0.726	4.010
Pelargyl "	C_9H_{20}	136-138	0.741	4.541
Rutyl "	$C_{10}H_{22}$	158-162	0.757	5.040
Undecyl "	$C_{11}H_{24}$	180-182	0.766	5.458
Lauryl "	$C_{12}H_{26}$	198-200	0.778	5.972
Conicyl "	$C_{13}H_{28}$	218-220	0.996	6.569
Myristyl "	$C_{14}H_{30}$	236-240	0.809	7.019
Benyl "	$C_{15}H_{32}$	258-262	0.825	7.526
Palmityl "	$C_{16}H_{34}$	280	.....	8.078

It seems probable that, when petroleum is dissociated by heat, the products of the dislillation must belong to another series than the marsh gas. I have already begun the examination of the products of dissociation of petroleum, and I hope I will be able before long to bring my results before the American Chemical Society. For the present I will only state that I have observed the phenomena of fluoresence in several liquid hydrocarbons, resulting from the destructive distillation of petroleum.

[Here follows a table containing valuable information about petroleum frrm different localities, taken from A. Wurtz's "Dictionnaire de Chimie."]

Important information is derived from this table, as it furnishes the coefficient for expansion of petroleum, and the knowledge of this coefficient determines the empty space which must be allowed in the vessel containing the oil. This space will be—

V. K. 50.

V represents the volume of the oil; K, the coefficient of expansion; and, at the same time, we base our calculation on the assumption that the oil is to be submitted to a change of temperature of 50° C.

The coefficient of expansion of Pennsylvania crude oil varies from 0.00072 to 0.00086, according to the amount of naphtha contained in the oil. These coefficients, therefore, bear a certain relation to the gravity of the crude oil, and for the products of distillation the following numbers can be generally adopted with satisfactory results:

Under 0.700,	gravity at 15° C.		=0.00090
Above 0.700 to 0.750,	"	"	=0.00085
" 0.750 to 0.800,	"	"	=0.00080
" 0.800 to 0.815,	"	"	=0.00070
" 0.815,	"	"	=0.00065

In the above table of Wurtz, the numbers representing the percentage of oxygen in the composition of petroleum are apparently too large, since the fact that crude oil generally contains sulphur is not taken into consideration. In Canada oil the amount of sulphur is large, but in Pennsylvania petroleum I have detected only traces of this substance.

PETROLEUM OR CRUDE OIL.

Petroleum has been classified as follows, according to quality:

First Class.—The production of Butler, Clarion, Armstrong, and Venango counties, Pennsylvania (excepting Bullion District).

Second Class.—The production of Warren, Tidioute, Fagundas, and Garland Districts, Pennsylvania.

Third Class.—The production of Bullion District, of Venango County, the Bradford District, of McKean County, Penn., and the Limestone District, of Cattaraugus County, N. Y.

Inspectors appointed to examine petroleum must employ all the means they possess for the determination whether an oil really is within the contract of sale.

A fractional distillation of ten parts is generally considered an examination of petroleum. This process is short, but the result is far from being satisfactory, and it is for this reason that we have entirely rejected it, and have adopted instead the fractional distillation of one hundred parts. The advantaues gained are the following: 1. Exact determination in volumes and weights of the different products, as naphtha, benzine, burning oil, and residuum. 2. The determination of the presence of paraffine oil as soon as it appears in the products of distillation. Paraffine oil is always present in the distillate when the first products of decomposition are observed.

When petroleum is heated, one part of it will distill, and if the distillation is fractioned into one hundred parts, the specific gravity of each hundredth is always increasing until the hydrocarbons remaining in the retort reach a temperature at which they cannot exist; at this moment, therefore, decomposition occurs, and the result is a deposit of carbon and paraffine in the retort; also, gases escape, and a decrease in the specific gravity of the distilled liquid observed.

The phenomenon of decomposition can be explained in the following way:

According to the hypothesis of R. Pictet, temperature is the measure of the amplitude of calorific motion—*i. e.*, the amplitude of motion increases directly with the temperature. At first the amplitude of motion produces merely distillation; but in continuing the distillation a point is reached where the hydrocarbons remaining in the retort reach a temperature at which they cannot exist without undergoing a partial decomposition, although this temperature is not high enough to produce ebullition. In short, the hydrocarbons C_nH_{2n+2} are decomposed before reaching their points of ebullition. The products of decomposition are substances of lower gravity and boiling point; therefore, instead of an increase, a decrease of specific gravity, as well as temperature, is observed. The decrease in the temperature also shows that the dissociation has been accompanied by an absorption of heat.

The point where dissociation occurs during the distillation of petroleum is of importance for the refiner, for, from this point until the end of the distillation, paraffine is deposited in the retort, and the last portions of the distillation give only paraffine oil, which is not fit for illuminating purposes. Burning oil need not, however, be entirely free from paraffine. It is, to the contrary, in the interest of the refiner to employ as much as he can of this product, but he must always bear in mind that paraffine oil decreases the illuminating power of the burning oil.

During the distillation a thermometer must be placed in the retort to show at any moment the temperature of the vapors, as this observation of temperature is very important. A certain relation exists between the temperature at which a product distills and its specific gravity. When a sample of pure petroleum is distilled in one hundred parts, the temperature at which each hundredth distills follows an arithmetical progression, as also

do the densities of each hundredth. The temperature when distillation commences varies; but with an increase of 2° C. we also notice an increase of specific gravity of 0.002. This increase of temperature and specific gravity begins only when the lighter products have distilled, and cease with the appearance of the first products of decomposition.

One of the greatest advantages of the fractional distillation in one hundred parts is a positive knowledge acquired upon the purity of the sample submitted to examination. If, during the distillation, before the appearance of the products of distillation, when the temperature has reached about 320° C., the distillation is stopped, the specific gravity of the remaining oil in the retort must agree with its theoretical specific gravity. If, between the observed specific gravity and the theoretical specific gravity, there should exist a noted difference, and, on the other hand, if, during the first part of the distillation, the densities and temperatures had not followed a regular progression, the conclusion is that the petroleum under examination is not pure, and will interfere seriously with the interest of the refiner. I should observe, however, that even for a pure sample of petroleum, the theoretical and observed specific gravities always differ slightly, since, during the first part of the distillation, a certain amount of uncondensable gas escapes and cannot be taken into consideration for the calculation of the theoretical specific gravity.

During the distillation the appearance of the distillate must be carefully noted, the most important being the color of the products distilled, and also the temperature when paraffine oil commences to solidify, by cooling with cold water. But not only the point of solidification need be observed, but also the temperature at which the oil loses its transparency. The fluorescent appearance of the distillates should likewise be noted. The last products of distillation show generally a blue fluorescence; should, however, a green fluoresence be observed, the sample of petroleum is suspicious, as I observed that this is found in petroleum to which residuum of former distillation had been added.

In order to save time during the distillation, I use the following apparatus, in which the product of the whole distillation is allowed to pass into or through the same vessel. This glass vessel is marked to contain exactly 20 c.c. in the lower part, and 10 c.c. in the upper; this latter part is connected with a syphon of a special form, which, when in action, each time removes 10 c.c., or 1 volume. The lower part is filled with two volumes, having a density, d, giving a weight $2d$. 1 volume, or 10 c.c., is received from the worm, having a weight or density, d_1, which is found from the whole specific gravity, D, by the use of the following calculation. The glass contains $2d+d_1$, having a density $(2d+d_1)\div 3=D$. The density, D, is given by a densimeter plunging in the glass vessel. The density, d_1, is evidently $d_1=3D-2d$; it remains in the glass, 2 volumes having a weight, 2D; another volume, d_2, is received, and when the syphon is filled it contains 3 volumes, having a density $(2D+d_2)\div 3=D_1$, whence $d_2=3D_1-2D$. The densities, d_2d_4—dn, are obtained in the same way. The syphon discharges the liquid in a vessel containing a densimeter, indicating the specific gravity of the distillate. For a receiver divided in 10 c.c., as described above, the quantity of petroleum to be distilled is 1 kilogramme.

An analysis of petroleum, conducted as above described, is not yet complete for the purposes of a refiner, it being necessary to add a lamp assay to determine the hourly consumption, and a photometric assay to determine the illuminatinn power of the burning oil. In order to make these two determinations, the distillate forming the burning oil is refined, as in the factories, by means of sulphuric acid, caustic soda and washing with cold water. When the water is separated from the oil, it is now ready for the determination of its flashing and burning point, and also for the lamp and photometric assay. The results of the analysis may be tabulated, as we have done in a former communication to the American Chemical Society, but it is more convenient to adopt a graphical method to represent the results. Upon the line of the abcisses the volumes are inscribed, and on the ordinates the specific gravities and corresponding temperatures, from which the curve of temperature and the curve of specific gravity are obtained.

Before distilling the sample of petroleum, it must be submitted to preliminary examinations; the first thing to ascertain is its specific gravity; the color and smell are noted. A thin layer of about two millimeter thickness is poured on a plate and left undisturbed for twelve hours, when it must not have any trace of soft or solid matter, but must remain fluid. A small quantity, about 100 c.c., of the sample is placed in a platinum dish and ignited. Pure petroleum treated in this way will burn almost entirely, leaving a residue having a weight not exceeding one per cent. of the crude oil used. This residue is composed partly of oxide of iron. Before, however, weighing the platinum dish, it must be heated to completely burn the carbon deposited on its sides during the burning of the petroleum. For the distillation of petroleum I have adopted a copper retort, holding 2½ liters. A glass retort can be employed, but as crude oil contains generally some water, the glass is in danger, and severe accidents may result. It has been claimed that a glass retort offered the advantage that the distillation of paraffine oil could be observed. This assertion I doubt, and maintain that to make a distillation of petroleum in a copper still furnished with a thermometer, is more accurate to indicate the presence of paraffine oil, and is, at the same time, perfectly safe for the operator.

NAPHTHA.

In "The Proceedings of the American Chemical Society," Vol. I., p. 119, I have described a process for the determination of naphtha in crude oil. Two kinds of naphtha are in the market: crude naphtha or "distillate," and deodorized naphtha. Deodorized naphtha is generally asked for. Naphtha shall be colorless and sweet (deodorized), and of gravity of from 68° to 73° Baume.

Naphtha must not contain any oil; placed upon white paper, it must entirely evaporate, without leaving any greasy stain. A small quantity rubbed between the hands must evaporate quickly and leave the hands dry. To see if naphtha has been well washed, a small quantity is treated by diluted sulphuric acid in a bottle, and agitated; the acid and naphtha must remain colorless. If naphtha of a very light gravity is asked for, it is important to ascertain that it does not contain relatively heavy products; the only way to prove this is distillation, where, however, only the specific gravities of the last products are observed.

REFINED PETROLEUM.

According to the rules regulating the petroleum trade, refined petroleum shall be standard white, or better, with a fire test of 110° Fahrenheit, or upwards. After having verified these points, the inspector must satisfy himself that the oil is not acid, and does not contain too large a proportion of heavy oil.

Recently complaints were received from Germany about the quality of the kerosene received. It was stated that the burning oil received at Bremen was not well refined, and was often acid. During the discussion of the reclamations of the German merchants, it has been advanced that kerosene could not be acid, for if sulphuric acid had been present, the kerosene would have shown a dark color.

That sulphuric acid produces a dark color with burning oil, is a well known fact; but it must be remembered that in the action of sulphuric acid upon kerosene, when the sludge acid is produced, sulphuric acid is decomposed and produces sulphurous acid. Besides, the acid used for refining is not chemically pure, and generally contains oxides of nitrogen. From these remarks it follows, that if sulphuric acid is not present in burning oil, this substance may contain either sulphurous acid or oxides of nitrogen, if the acid treatment has not been followed by washing with alkali, and finally water.

To examine for these acids, we treat the kerosene with an alcoholic solution of caustic soda. After separating this solution, it is evaporated, and the residue examined.

To ascertain if the kerosene contains too large proportions of heavy or paraffine oil, it is cooled down and the temperature at which the paraffine begins to solidify, is observed. It is evident that kerosene must remain fluid at the winter temperature of the place where it is stored.

A very good way of ascertaining if kerosene has been well refined, is to submit it to a photometric assay.

First, a sample of about two liters is obtained and divided into two parts. The first sample is submitted to the lamp assay and to the photometric assay, then the second sample is refined by treatment with sulphuric acid, caustic soda and water. If the result given by the photometric assay of the second sample corresponds with the result obtained by the first sample, the kerosene examined was well refined. Heavy oils in kerosene decrease its illuminating power. If a sample of kerosene, after being well refined, has an illuminating power below a standard admitted, it will be safe to conclude that the decrease of brilliancy in the light is due to the presence of heavy oils. If, during the lamp assay, which furnishes the hourly consumption of kerosene, and enables us to compare the price of kerosene with the price of other kinds of lights, the wick of the lamp gives off fumes and turns black by carbonization during the burning of the last parts of the oil, this is an indication that the kerosene was not well refined, and was, perhaps, acid.

I have lately examined several samples of kerosene of the largest refineries of New York, and I did not meet with a single sample containing acids. The process of washing kerosene with water, and testing the washings with litmus paper, must not be relied upon, as often blue litmus paper is too alkaline to indicate small quantities of acid.

Kerosene must stand a fire test of 110° Fahrenheit. It has been often pointed out, that the fire test of kerosene is of little importance, for the real danger in the handling of oil is at the point where it gives off an explosive vapor. The French law requires that kerosene must not give off an inflammable vapor at a temperature of 35°C.

Several kinds of apparatus have been devised for the determination of the flash test and fire test of burning oil. The most reliable is an open vessel containing the oil to be tested; the inflammation is produced by an electric spark.

RESIDUUM.

The residuum must be free from coke, liquid at ordinary temperature, and must not contain any burning oil. In foreign countries the residue is free of duty, provided it does not contain any burning oil, otherwise the duty will be the same as for crude oil. The instrument used in America for ascertaining the gravity of petroleum and its products, is the hydrominor areometer of Baume. On the continent densimeters are generally substituted, and very often discussions arise about the gravity of petroleum, for the tables comparing degrees Baume and the density are not alike. I think that the areometer of Baume must not be entirely discarded, because the numbers indicating the gravity are smaller and more readily remembered than the numbers given by the densimeter. The construction of the densimeter is far more difficult than that of the hydrometer; their stems may be divided as to indicate specific gravities directly; for this purpose, if we denote by w the weight of the densimeter, by v the volume of the liquid displaced, and by d its density, we shall have

$$w = d.\ v,$$

as the equation which will enable us to calculate the volume displaced for any corresponding density, and allow us to graduate the stem accordingly. This equation is that of the hyperbola; if, therefore, the specific gravities be supposed to vary by equal differences, the corresponding volumes will vary unequally, or the stem must not be divided into equal parts, but into intervals proportionate to the difference of consecutive ordinates of the hyperbola. Such densimeters are consequently of rather difficult construction, and require skill and intelligence on the part of the manufacturer. In a former communication to the American Chemical Society, I have given the formula to be employed to transform the degrees of Baume's hydrominor areometer into corresponding specific gravities. (Proceedings of the American Chemical Society, Vol. I., p. 45).

[From the Baltimore "American," Sunday, January 4th, 1880.]

Electricity vs. Gas.

EDISON'S LATEST DEVICE REVIEWED BY AN EXPERT.

The Question of Cost—Enormous Expense of the Plant—Stations in the Large Cities—Gas Still the Cheapest and Best for Domestic Use.

A representative of the *American* yesterday met a gentleman prominently connected with the gas interest, who, during the past week, spent a day and night at Menlo Park, with the object of examining Edison's latest form of electric illumination, and comparing it—principally in respect to cost and practicability for domestic usage—with gas. This gentleman was willing to state in the briefest possible compass, the reasons that influence his positive opinion that the electric light, as now displayed at Menlo Park, cannot become a successful rival of gas. He had conversed with Prof. Edison, and the figures with regard to the latter's plans are given just as he stated them. The following expresses Edison's project for lighting in large cities, and the comments passed upon them by the gentlemen from whom this information is derived:

"In the first place," said he, in answer to questions of the *American* representative, "Edison proposes to use in cities engines of one thousand horse-power each, which would give him 8,000 lamps, his calculation being on the basis of one horse-power for eight lamps. Now, suppose that we estimate that on the average there are twenty-five houses in each block in a city—say Baltimore. Seven blocks would make half a mile, comprising one side of a district, so that in a district embracing a quarter of a square mile we would have 1225 houses. Edison admits that with his 1,000 horse-power or 8,000 lamps he can only provide illumination for a district of this size, and consequently the proportion for each house would be less than seven lamps. Say that Baltimore comprises six square miles, it would require 24 1,000-horse power engines to cover that ground; and this engine-power, at Edison's own calculation, would give only 192,000 lights, each of which is of less intensity than a good gas jet."

"Is that a fact as to the luminosity of his carbonized paper horseshoe lamps?

"Edison has not made a photometric test; but to my eye his light is not equal to sixteen candle power. There are 25,000 consumers of gas in Baltimore, besides four or five thousand street lamps. In the 24 hours of Christmas day and night there was burned in this city three million cubic feet of gas, which, of course, was all made or stored during the preceeding 24 hours. Edison's machinery would have to be adequate to furnish these three million feet between the hours of 5 o'clock and 12 o'clock P.M., as he cannot store electricity, but must produce it as it is called for. Divide three millions by seven—the number of hours during which there was the heaviest demand for gas—and we have 428,570 feet as the hourly consumption, or equal to 100,000 in round numbers of Edison's horseshoe lamps. But, for a portion of these seven hours, the consumption was double that, or equal to 200,000 of Edison's lamps. We see that his two dozen one thousand horse power engines would fall just a little short of doing this, even granting that he can accomplish what he expects in his ratio of horse power to light. But the most he has done is to light 40 lamps with an engine capable of working up to eighty horse-power, and he has not lit more than 40 lamps from three of his generators."

THE MULTIPLICATION OF DISTRICTS.

"How about the stations and districts?"

"Edison names 1000-horse power as generating as much electricity as he can dispense from one station, and the district is to be only a quarter of a square mile, otherwise the distance would be too great for the operation of his system. If he has one station to start with he must obtain as customers all the consumers in that district of a quarter of a square mile, for he cannot travel outside of it to get consumers without establishing a new station, with all of its apparatus of boilers, engines, generators, etc. By his own figures there must be 200 generators to each engine to convert its steam power into electric force. A 1000-horse power engine and its appurtenances such as coal yard, etc., in the centre of a choice district in the city would occupy a large amount of valuable ground. His smoke stack would be another formidable affair; for, when he was burning 300 pounds of coal hourly, which his engine would require, a stack enabling him to deliver the products of consumption high enough in the air not to create a nuisance, must be very costly. Buildings to accommodate all this machinery would necessitate a huge outlay; and think of 24 such stations in the city! This is only a theoretic deduction from his experiments, and it is doubtful whether he can do on a large scale what he does in his laboratory. Then there comes in the question of the labor about such an establishment, which, again, would be very costly. I will show you something bearing upon the expense. At the West Side pumping works in Chicago an engine worked at about 400-horse power, but capable of 600, was run for 55 days in Novembe and December of 1876. The cost of running was $1,430 for salaries and wages; oil for cylinder, $101; lard oil, $142; tallow, $18; packing, gaskets, etc., $127; sundry expenses, $7; lighting the building, $524; repairs, $45; a total of $2,394, or about $44 per day. This is exclusive of coal, of which there was burned 1,080,000 lbs."

COAL AND WATER.

"How would Edison's total of expenses stand?"

"His thousand horse-power engine would take at its maximum working 25,000 pounds of water per hour for conversion into steam. If he used a condenser it would take even more. That is over 3,000 gallons of water hourly, and 3,000 pounds of coal for each engine. He must have all this, for the reason that he has to be prepared at any moment to give his customers the outside quantity of electricity needed. A gas company can take a day or two to make the illuminating element that Edison must furnish immediately, and therefore his plant is very expensive. His conductors are to be laid in underground tubes insulated on the inside. These tubes will cost as much per foot as the smaller gas pipes, and the cost of the copper wires for conduction is another considerable item. The skilled labor required to lay these tubes and wires would be at least twice as expensive as that of the men who do the corresponding work for the gas corporations. You will see that there is altogether involved the cost of the engines, boilers and generators, together with that of the city property needed for the stations, the outlay for the buildings, coal, water, labor and the expense of conductors for the current; and the aggregate must certainly go so far beyond the cost of gas that there can be no comparison between the two methods of illumination. The gas companies have their mains and pipes already in place, and Edison must supplant the whole system. They are already occupying the ground, and if their plant had to be written down, still the people could not afford to throw it away. The probability of Edison being able to compete successfully with gas can be judged from the fact that he has now a light inferior in illuminating strength and superior in cost, and he cannot modify it as we do gas—by regulating the flow, but it has to be burning in full or not at all, making it necessarily expensive to the consumer."

GAS AS EDISON'S MODEL.

"At Menlo Park they do not hesitate to say that they are trying to make something as good as gas, and they admit that they have not as yet succeeded. Now, the limits of the usefulness of gas have not yet been reached. The era of cooking by gas is so near that it will soon be here, and the price will then doubtless be decreased. Gas saves fuel in a house on account of the heat given out by the burners, and we have gas engines that are quite economical in their operations. The products of the consumption of gas can be easily carried off, and in such a way that they will carry with them the other impurities of rooms, thus conducing to perfect ventilation. Gas can be sent all over the city from one producing point, but Edison's system proposes a station in every district embracing not more than a quarter square mile in extent. Altogether, I do not think that the holders of gas stock need fear that Mr. Edison is going to impoverish them."

Cum Grano Salis.

Sensational reports about Edison's electric light, like sensational reports about anything else, must not be swallowed with implicit faith. Whenever a thing is talked about as much as this subject has been for some months, it must be remembered that an army of unscrupulous speculators has already gathered at each money centre to fill their own pockets by bulling or bearing the stock. For instance, the Menlo Park investigator simply announced that he had found pure carbon better for his purpose than platinum, and as he hadn't thought of anything better than pure carbon, he thought that this would be the wick of the future cheap electric lamp. The grand army of sensational speculators, including some interested newspaper men, at once circulated the most exaggerated reports, to make the stock jump. It jumped. They filled their pockets, and in order to fill them again they now begin to pull the stock down, by exaggerating one or two natural laboratory accidents into a fizzle-out of the whole electric light experiment, so that they can buy in some more shares at a low figure.

So much for the speculators. Now a word to the public, who merely want the truth, and have no ax to grind. Mr. Edison, by his modesty, forbearance, and perseverance, has commanded respect. There is an undercurrent of confidence in him deep in the minds of all well-informed people. Everybody realizes the fact that a genuine cheap electric light will be an immense thing, and that it is not yet proven to be accomplished. Consequently everybody should be on his guard against making too much of one or two or three steps toward its actual accomplishment, which must necessarily consist of many steps gradually taken. This is the experience of all scientific discoveries. That Mr. Edison has made some undoubted progress with electric light is plain. Suppose he should drop dead to-day, and an aerolight or something else should demolish his laboratory, still no one could deny that Edison has stimulated inquiry and experiment, and twenty more patient, modest, laborious future Edisons would spring up to help the world a little further on. It will not kill any of us to use gas a while longer, unless we blow it out instead of turning it off. Meanwhile, our advice to everybody is, don't believe anything about Edison's electric light except what is proved to your reason. *Festina lente.* Draw it mild. Go slow. Wait.—*North Am. and U. S. Gazette.*

The Electric Light Thirty Years Ago.

The editor of the *Mechanics' Magazine* says: "The public has experienced so many disappointments respecting this light, it has been so often represented as attended with 'perfect success,' without that perfect success ever leading to its practical adoption anywhere, that people have fairly enough begun to regard with exceeding incredulity any announcement respecting it. We do not hesitate, nevertheless, to present our readers with an account of one exhibition more which has been communicated to us by a correspondent upon whose judgment and impartiality we place great reliance; for it does appear from it that all the difficulties of the case have at length been really surmounted, and an actual electric lamp produced, which gives a steady, enduring, and most brilliant light, without any perceptible flickering or intermission. On Monday last there was an exhibition at Crosby Hall of Mr. Staite's electric light, which demonstrated more decisively than has ever yet been done the capability of its application to domestic and public illuminating purposes. Mr. Staite made use of a regulating magnet on the plan fully described in the *Mechanics' Magazine*, Vol. L., p. 48, and most admirably did it perform its functions. In addition to the advantage of being self-acting this apparatus is so sensitive of the slightest variation in the electric current, and so instantaneous in its controlling action, that no unsteadiness of light is perceptible. Mr. Staite also exhibited a small iridium lamp, in which the illuminating medium was composed, as the name indicates, of iridium, and which appeared to be particularly applicable to domestic and other purposes where a very powerful light is not required, but one that will last long without attention, and be of little cost. Another lamp, in which carbon points were employed for producing the light, was subsequently exhibited, and certainly for steadiness and brilliancy it surpassed every other known artificial light—so powerful, indeed, that the eye could not look upon it without being painfully fatigued. To counteract this to some extent, it was inclosed in an enamel glass globe of about 24 inches diameter, which appeared as an enormous globe of pure and brilliant white light. There can be little doubt that ere long we shall see gas and oil lighting, with all their attendant evils of blacks, heat, etc., replaced, at least in all large public buildings and thoroughfares, by the electric light."

The above, which reads like a paragraph of yesterday, was published in the *Family Herald* of the 2d of February, 1850—*nearly thirty years ago*—and it seems likely that a very similar paragraph may be read thirty years hence.

Illuminating Railway Carriages.

A better system of illuminating railway carriages has long been desired. To our mind, the simple lighting with common coal gas proved eminently successful; but the misfortune was that the bags containing the gas required frequent refilling. One of the first men to recognize this difficulty was Herr Pintsch, of Berlin, who invented a method of obtaining permanent gas from crude petroleum oil, and compressing it into large cylinders, from which smaller cylinders, placed under the railway carriages, were filled. What we consider an improvement on this plan has been recently experimented upon by the Chartered Gas Company, who have been carburetting the common gas made at the King's Cross works, by means of an apparatus invented some time since by Mr. Frank W. Clark. The gas, saturated with the vapor of petroleum, is compressed to about ten atmospheres, in cylinders placed on the tops of carriages, and thence supplied to the burner in a compartment of a carriage. The burner used is, we believe, a modification of Sugg's "London" Argand, being furnished with a flash-light fixed in the centre of a ring. With this latter appliance—the gas for it being supplied at high pressure as compared with the Argand—there is no fear of the lights becoming extinguished under any accidental circumstances. Should, for instance, a collision occur, and the larger flame be extinguished, the smaller one will immediately re-light the gas, and thus continuity of the illumination is maintained. The compressed mixture, which is represented by about ninety-eight per cent. of ordinary coal gas and two per cent. of petroleum, gives, we are told, an illuminating power of between thirty and forty candles, and thus, if a fair quantity be burned, the illumination must be in the highest degree effective. It is satisfactory to know that a carriage thus lighted is able to travel from London to Aberdeen and back without requiring any replenishment.—London *Journal of Gas-Lighting*, Dec. 9.

Artificial Diamonds.

Prof. Nevil Story Maskelyne, F.R.S., of the British Museum, has examined the presumed "diamonds" manufactured by Mr. James Mactear, of St. Rollox, Glasgow, and has published the result of his examination in a letter to the *Times*, from which the following is extracted:

"Firstly, the diamond excels all substances in hardness. Secondly, its crystals belong to the cubic system, and should not, therefore, present the property of doubly refracting light. Frequently, however, from the influence of strain within the crystal, caused by enclosed gas bubbles or other causes, diamonds are not entirely without action on a ray of polarized light sent through them. Finally, the diamond is pure carbon, and, as such, burns entirely away when heated to a sufficiently high temperature in the air, and more vividly so burns or glows away when heated in oxygen gas.

"The specimens I had to experiment upon where too light to possess appreciable weight, to small even to see unless by very good eyesight, or with a lens, yet were, nevertheless, sufficiently large to answer the three questions suggsted by the above properties.

"A few grains of the dust, for such the substance must be termed, were placed between a plate of topaz—a cleavage face, with its fine, natural polish—and a polished surface of sapphire, and the the two surfaces were carefully "worked" over each other, with a view to the production of lines of abrasion from the particles between them. There was no abrasion. Ultimately the particles became bruised into a powder, but without scratching even the topaz. They were not diamond.

"Secondly, some particles more crystalline in appearance than the rest, were mounted on a glass microscope slide, and examined in the microscope with polarized light. They acted each and all powerfully in the manner of a birefrangent crystal. It seemed even in one or two of them that, when they lay on their broadest surfaces (it can scarcely be called a 'crystal face'), a principal section of the crystal was just slightly inclined to a flattish side of it in a manner that suggested its not being a crystal of either of the ortho-symmetrical systems. Be that as it may, it was not a diamond.

"Finally, I took two of these microscopical particles and exposed them to the intense heat of a table blowpipe on a bit of platinum foil. They resisted this attempt to burn them. Then, for comparison, they were placed in contact with two little particles of diamond-dust exceeding them in size, and the experiment was repeated. The result was that the diamond particles glowed and disappeared, while the little particles from Glasgow were as obstinate and unacted on as before. I had previously treated the specimen I have alluded to as the first on which I experimented by making a similar attempt in a hard glass tube in a stream of oxygen, and the result was the same. Hence I conclude that the substance supposed to be artificially formed diamond is not diamond and is not carbon; and I feel as confident in the results thus obtained from a few infinitesimal particles that can hardly be measured, and could only be weighed by an assay ballance

of the most refined delicacy, as if the experiments had been performed on crystals of appreciable size.

"Not content with proving what these crystalline particles are not, I made an experiment to determine something about what the are.

"Heated on platinum foil several times with ammonium fluoride, they became visibly more minute, and a slight reddish-white incrustation was seen on the foil. At the suggestion of Dr. Flight, assistant in this department, a master in the craft of the chemical analyst, these little particles were left for the night in hydrofluoric acid in a platinum capsule. This morning they have disappeared, having become dissolved in the acid, and on evaporation there is seen a slight white incrustation, on the capsule, of the residuary fluoride. I have, therefore, no hesitation in declaring Mr. Mactear's 'diamonds' not only not to be diamonds at all, but to consist of some crystillized silicate, possibly one resembling an augite, though it would be very rash to assert anything beyond the fact that they consist of a compound of silica, possibly of more than one such compound."

Mr. Maskelyne concludes that "The problem of the permutation of carbon, from its ordinary opaque black condition into that in which it occurs in nature as the limpid cyrstal of diamond, is still unsolved. That it will be solved no scientific mind can doubt, though the conditions necessary may prove to be very difficult to fulfill. It is possibe that carbon, like metallic arsenic, passes directly into the condition of vapor from that of a solid, and that the condition for its sublimation in the form of crystals, or its cooling into crystal-diamond from the liquid state, is one involving a combination of high temperature and high pressure present in the depths of the earth's crust, but very difficult to establish in a laboratory experiment."—*Journal of the Society of Arts.*

[Communicated Article.]

About Stopped Pipes in the Retort House and Their Remedy.

By Frederic Egner.

Stopped pipes in a retort house are, as every gas man knows, a source of trouble and loss. Whenever the retorts are kept at what is termed "high heats," choked ascension, bridge, and even dip pipes appear more frequently than when the reverse is the case. The well known practice of cleaning the lower end of the ascension pipe, just before charging a retort, is not a preventative against stoppages; and it is an old thing for retort house firemen to place a shovelful of wet coal in the mouthpiece of a freshly-charged retort before closing the same, to prevent a stoppage in the pipe, or to clear one partly stopped. The expedient generally accomplishes its purpose; but as coal in the mouthpiece is just so much waste, this practice cannot be approved. But it has led to the placing of a few shovelsful of wet ashes or "breeze" in the mouthpiece instead of the coal, for the same purpose, and with the same results. The author of a communication on the subject of stopped pipes, recently published in the American Gas Light Journal, stated that he had placed iron vessels filled with water in the mouthpieces of retorts, and finding it to work well, had invented and patented a retort lid, "With a receptacle for water on the inside," which gave him entire satisfaction after practically testing the same. It would be needless occupation of space in the Journal to recount the numerous devices to prevent or remedy the evil of choked pipes, all of which are more or less well-known—patented and otherwise.

The following is not patented, consequently free to all; and as it has been proved by practice to be speedily effective when applied, and is both simple and cheap, it can be recommended by me, especially to engineers of large works, where the waste by stopped pipes is sometimes very considerable.

Connect a small—say ¾-inch steam pipe—with the mouthpiece, or ascension pipe, just above the mouthpiece, of each retort in the following order, viz.: Next to the mouthpiece a nipple, then a "T," the outside end of which is closed with a plug, which, when removed, admits of using a rod to clear the "T," should that become necessary. To the upper branch of the "T" connect a steam cock, and from this run the pipe to a main steam pipe (say ¾-inch pipe) laid along the hydraulic main. When a pipe is found stopped, turn on the steam for from *ten* to *fifteen seconds*, when it will be found cleaned. The saving of labor to the firemen, and of gas to the company, will be obvious to any man of experience in a retort house.

Norfolk, Va., Jan. 19th. 1880.

Proposals for furnishing illuminating gas for lighting the public markets, armories, buildings and offices of the city for the year 1880 were opened by the Commissioner of Public Works, on Wednesday, Jan. 21. The bids were as follows: New York gas company, gas of 16 candle power, $1.40 per 1000 c. f.; Manhattan gas company, gas of 18 to 22 candle power, 75 cents per 1000 c. f.; Mutual gas company, gas of 19 candle power, $1.50 per 1000 c. f.; Municipal gas company, gas of 22 candle power, $1 per 1000 c. f.; Metropolitan gas company, gas of 19 candle power, 60 cents per 1000 c. f.; Harlem gas company, gas of 16 candle power, $1.25 per 1000 c. f.—*C. T. J.*

[From the "London Journal of Gas Lighting."

Controlling the Supply of Gas from the Gasholder to the Burner.*

In a paper I read some years ago before the Royal Scottish Society of Arts, Edinburgh, I gave a table showing the great loss incurred by gas companies through leakage, when pressure in the gas main is not under proper control; and in a paper read before the same society last April I showed how the illuminating power of gas is destroyed by burning it at even what might be termed no very heavy pressure. In the first instance, the loss is sustained by the gas company, in the second by the consumer; so that pressure, like fire or water, is a useful servant, but in all cases a bad master. In gas manufacture and gas distribution it is a great enemy to economy, and meets the gas manager in the very first stage of his working, hindering the production of gas, and favoring the production of carbon in the retorts. The exhauster gives thorough control here, doing for the retorts what the ordinary governor does for the mains, relieving them of pressure, and helping largely in the economy of the first and most important part of the operations of a gas company, viz., the manufacture of a useful and saleable article with certainty and at a low price. Within the gates of a gas works the engineer, the architect and the chemist have a wide field, which is being more and more worthily and successfully covered. It is no very uncommon thing now-a-days to find these three professions well represented by a gas engineer, and it is the one who can bring these three qualifications to bear upon the buildings, apparatus and operations of a gas works, who will fill his holder with the best and cheapest gas, and must, therefore, be considered the best gas maker, although a heavy percentage may be lost by leakage through imperfections in the distributory system. It cannot be particularly pleasant to the successful gas maker to find that 10, 20, and even 30 per cent. of what he has made is to be lost to him by leakage. He has the bird in his hand, and yet it flies away after all his care in caging it. To prevent this, and get the least amount of leakage and the greatest illuminating power, he requires to have a thorough means of controlling pressure from the gasholder to the burner.

I need not take up your time with descriptions of gas governors you are all so familiar with now. I shall, therefore, only call your attention to one or two forms, one being the governor invented by Goldsworthy Gurney, the distinguishing feature of which is that the valve and the bell are of the same diameter. I shall allude to this more particularly afterwards.

The large size demanded for the bell of the ordinary station governor is necessary to counteract the action of the inlet gas on the bottom of the valve and also to obviate the tendency of the governor to get into a state of pulsation or bobbing, which often comes on unexpectedly and unaccountably. From long and repeated observations, I have come to the conclusion that these pulsations have a certain relation to particular stages of the delivery of gas through the governor. The pulsation is always ready to take place when the delivery is small. On increasing the flow of gas, by opening burners, steadiness will set in, and continue until at another point a particular state of equilibrium is arrived at, which again sets up the pulsating movement. I have been inclined to think that there is some analogy between this phenomenon and the vibratory motion of the string of a musical instrument. At the nodal points of the string there is an absence of vibration, while further on vibration takes place, and continues at that particular place until some change is made in the subdivision of the string, which changes the position or point at which the vibrations were before strongest. This may, perhaps, be considered a little far-fetched, but what may be called the capricious behavior of the governor in commencing to pulsate without any apparent cause may yet be found to have some definite relation to certain proportions of the bell and the valve, and certain relations between the inlet and outlet pressure, in conjunction with the quantity of gas passing through the valve. The mere size of the bell will not altogether prevent pulsations, therefore something else must be sought for and applied in order to stop them altogether. In the common governor the parabolic form of valve gives the best results, the reason in my opinion being that when near the closing point a good traverse of valve may be allowed without a great difference being made in the volume of gas delivered, but even with it at some particular point, and after years of good behavior, pulsation will set in, and defy all efforts to stop it unless additional friction be applied to the moving parts, which takes away the delicacy of action so much desired and looked for. After many trials of different forms of valves, I constructed one which in a manner acts as if it were six different valves. It is something in appearance like a drum, and the angular or parabolic openings are not unlike the outline of the tension cords for tightening the drumhead. These openings are made to open or uncover in successive stages, and are very effectual in keeping back pulsations, besides allowing the governor to be made of much smaller dimensions than usual.

* A Paper read by D. Bruce Peebles, Esq., before the West of Scotland Association of Gas Managers.

I have already alluded to the Goldsworthy Gurney governor, and stated that it has a bell and a valve of the same diameter. These are connected by a tubular stem, and the inlet gas acts on the top of the bell and the under side of the valve, the inlet pressure being thus neutralized. The action of the governor depends on the outlet pressure alone, but the valve being large and of the same diameter as the bell, a small traverse gives a large delivery of gas, and spoils the action of the governor. I have adopted quite a different arrangement from that. Openings are cut in the drum-valve which is connected with the bell by a rod passing up the central pipe, through which pipe also the gas reaches the bell. A weighted lever is applied to counterbalance part of the weight of the valve and bell, or a float may be fixed to the bell for that purpose. In order to obviate the tendency to pulsate, the valve-seat is made of the peculiar form shown—having a perforated shell with angular openings, which the valve uncovers successively. I have found this arrangement gives excellent results, both as regards delicacy of action and freedom from pulsations. Those now in use are giving every satisfaction.

Following up the same idea, I adopted the drum-valve in the construction of a dry metallic district governor for reducing pressure in street-mains. The objection to governors with leather diaphragms for such situations had been urged, and not without reason, and I wished to get rid of leather and liquid also. The valve of this new district governor is made of block tin, and kept so tight as to come into action at a pressure of from 5 to 7-10ths. It responds to the action of the station-governor, and enables the manager to work with a reduced pressure in particular districts during the day, which is increased automatically when pressure is put on at the works. The valve is of delicate construction, and, like a wet meter cylinder, requires careful handling when out of its place, but when once in its seat it will do its work without care or attention, and being made of block tin may be expected to last as long as, if not longer than a meter cylinder, seeing that is never in contact with water. I have no doubt these governors will be found to supply a want which has long been felt, in connection with the control of pressure in districts where altitude or other disturbing elements interfere with proper distribution and supply.

This finishes the subject so far as the gas manager is concerned, with the exception of public lamps. We have now conveyed the gas as far as the meter, and there we are compelled to leave it to be handled by the gas-fitter as he best thinks fit. But before quitting this part of the subject I should like to make a short quotation from the discussion which took place after the reading of an excellent paper by Mr. Chew, of Blackpool, on "The Distributing Apparatus from the Gasholder to the Consumers Burner," reported in the *Journal of Gas Lighting*, published on Tuesday, the 16th of September. In summing up the discussion, Mr. Newbigging, the eminent consulting gas engineer, President of the Manchester District Institution of Gas Engineers, said: "Reverting to the subject of leakage, he had just been making a rough calculation that in this country about 90,000 million cubic feet of gas was made per annum. Supposing the leakage on this to be 10 per cent., that would be 9000 millions, and taking this quantity at 2s per 1000 feet, the total money value of the leakage would be represented by £900,000, Here was a mine of wealth in which all gas managers might dig, and of which they might all secure their proportionate share."

Having so lately spoken of the needle lamp governor, I need not now say much about it, but I made no apology for bringing under your notice and showing you the effects of pressure in destroying the illuminating power of gas. No doubt there are few who are not quite aware of the deteriorating effect of pressure on a gas-flame; but, on the other hand, I believe there are not many who have seen a series of gas-flames burning simultaneously at digerent pressures, while passing the same quantity of gas, and I think if any manager had a small apparatus like that now before us to show the quality of his gas to grumbling consumers, it would do more good than advancing arguments which the grumblers cannot understand, or making statements they are doubtful about believing.

These [pointing to four needle governors as illustrated in the *Journal* for Aug. 5, p. 219] four needle lamp governors are each set to consume exactly 5 cubic feet of gas per hour—the first at 3-10ths, the second at 8-10ths, the third at 13-10ths, and the fourth at 17-10ths pressure. It needs no argument of mine to show what the apparatus so clearly proves, and yet I believe there are some here who, looking at the extraordinary difference in the illuminating power of the flames, will doubt whether it can be possible that the first and fourth burners are actually burning 5 cubic feet. I do not blame them and were these two flames placed in separate rooms, a doubt might not unreasonably be raised as to whether they were burning the same gas. I assure you they have been carefully rated, and their accuracy may be relied upon.

I now briefly call your attention to the needle governor burners—for ordinary use in our gaseliers and brackets. These do all that the large-sized lamp governors do, although they are not rated to pass an exact quantity of gas per hour. But they may be used with confidence where perfect combustion is required, and the full illuminating power of the gas desired, along with a purer and less heated atmosphere than where ordinary burners are employed. We shall try them at pressures varying from 8 to 30-10ths, and we shall see that while the common burner flares up as the pressure is increased, the flame of the needle governor burner is practically the same at all pressures. Taking Mr. Newbigging's estimate of loss by leakage, I should be inclined to say that much more loss is suffered from excessive pressure at the burner. That is a point which will more and more force itself on gas engineers, and I believe the day is not far distant when their advice will be eagerly sought by consumers, instead of being doubted, as is too often the case at present. Exhibitions of gas apparatus, such as that which took place at Greenock, tend to bring the gas maker and the gas consumer face to face, and the makers of the apparatus do good service to both. Before long I believe every gas company will have attached to its offices an exhibition-room, where the best forms of gas-stoves for cooking and heating and the best kinds of burners, globes, etc., for the purpose of lighting will be always ready to be shown. Ocular demonstration is the easiest way of convincing people. The proverbial phrase, "Seeing is believing," can never be more appropriately applied than in connection with the development of the illuminating power of coal gas.

Discussion.

Mr. Watson (Stirling), referring to the experiment which had been performed with the four governor burners, questioned whether the 1st and 4th burners were both passing 5 feet of gas an hour. The smaller one, he said, appeared to be consuming more like 2¼ feet per hour.

Mr. Jeffrey (Kirkintilloch), said this only showed how beautifully the needle governor controlled the flow of gas. He thought this was a subject that had not been sufficiently ventilated by gas managers themselves. For himself, he could hardly believe the result. He considered it their duty as gas managers to advise consumers as to the best mode of burning gas, as he believed, by the present mode, from 20 to 30 per cent. of that used was lost.

Mr. Peebles—In some cases more than 50 per cent.

Mr. Adamson (Anstruther) asked Mr. Peebles if he had any theory to account for the difference, except the increased pressure.

Mr. Peebles said this point was discussed at the recent meeting of the North British Association of Gas Managers at Edinburgh, and the theory advanced by the chemists was there upheld—viz, that with the small burner the gas issued at a much greater velocity than with the large burner, and therefore forced itself against the air and mingled freely with it, thus getting a large supply of oxygen. The hydrogen had not time, as it were, to release the carbon, so that part of the hydrocarbon burned as a gas, while with the large burner the gas issued slowly at a low pressure, and had not an opportunity of mixing freely with the air. The hydrogen in this case showed its affinity for oxygen by seizing on it and releasing part of the carbon with which it had been combined, and these particles were raised to incandescence by the high heat of the burning gases, hydrogen, oxygen, and part of the unreleased carbon, thus giving a beautiful large flame.

Mr. Adamson remarked that the larger flame was yellower and more sluggish than the other.

Mr. Peebles said this point was, and the higher the pressure the less luminous the flame became. With regard to Mr. Watson's remark, he said that the difference between the flames of the first and fourth burners was something extraordinary, and with English gas it would be still more marked. The lower the illuminating power of the gas, the less pressure must be applied in burning it, and this was the experience of all those who had had anything to do with air gas, especially when the lightest portion of the volatile carburetting fluid had passed away. In such cases the pressure must be exceedingly low in order to get any illuminating power at all.

Mr. McGilchrist (Dumbarton) said he tested some of Mr. Peebles's governors when they were first introduced, and found that up to 4 inches of pressure the quantity of gas consumed was practically the same. If, therefore, the four burners exhibited had been tested up to 2 inches of pressure, and at that pressure the four each consumed 5 cubic feet of gas per hour, he held that the proportionate consumption must be the same—viz., if the burner that was giving the best flame was not consuming 5 feet of gas per hour, then the smaller burner would be consuming just in the same ratio, because in conducting his experiments he found no difference between one inch and four inches of pressure. There should then be no difference here, and the illustration given should be proportionately correct with 17-10ths pressure.

[To be concluded.]

Sorel's Cement.—Mix commercial zinc white with one-half its bulk of fine sand, adding a solution of chloride of zinc of 1.26 specific gravity, and rub the whole thoroughly together in a mortar. The mixture must be applied at once, as it hardens very quickly.

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

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MONDAY, FEBRUARY 2, 1880.

Official Report of Examinations of Gas for two Weeks ending Jan. 10, 1879, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

Dec. 1879.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
29		16.81	16.64	20.31	16.94	16.62	
30	Between	16.93	16.75	18.79	16.66	16.56	
31	9.30 A.M.	16.81	——	19.43	16.63	16.48	
Jan. 2	and 1 P.M.	16.62	16.49	19.53	16.22	16.46	
3		16.61	16.54	18.51	15.56	16.31	
	Average	16.75	16.60	19.31	16.40	16.48	
5		16.34	16.02	18.23	16.36	15.80	
6		16 37	16.08	18.00	17.08	16.51	
7		16.71	16.57	19.09	17.19	16.75	
8		17.23	16.78	19.22	17.30	17.21	
9		17.10	17.41	19.07	17.71	17.01	
10		17.26	17.12	18.77	18.08	17.00	
	Average	16.83	16.66	18.73	17.28	16.71	

Sugg-Letheby burner.

E. G. LOVE, Gas Examiner.

Kerosene Fatality.

A distressing accident occurred at the residence of Rev. W. Shorts, in Woodstock village, on Jan. 19. Miss Ellen Chrisler, an estimable young lady who has been brought up by Mr. Shorts' family, was terribly burned by the explosion of a kerosene lamp she was holding in her hand. The burning oil was thrown all over her, and she was soon enveloped in flames. The unfortunate victim lingered in great agony till last night, when she died.—New York *Herald*, Jan. 22.

Correspondence

[We are not responsible for the opinions expressed by Correspondents. Correspondents, in all cases, should sign their communications with their names and address in full—not for publiction, unless desired, but as a guarantee of good faith.—ED.]

Water Gas.

Mr. Editor:—Your valuable journal has contained various communications on the subject of the poisonous nature of carbonic oxide, contained in what is known as water gas. It was asserted that it is a blood poison, and that persons inhaling it cannot be revived, or escape its effects, by an exposure to the open air, as in case of coal gas; and the opinions of scientists were largely quoted to sustain that theory.

You allowed me in your journal of June 30, 1877, and August 16, 1879, to give my reasons, based upon known facts, for not believing in that theory. But no stronger evidence as to the actual truth of the matter can well be obtained than appears in the editorial columns of the Poughkeepsie *Daily Eagle* of Dec. 29th last, as follows:

"HE BLEW THE GAS OUT—A NARROW ESCAPE FROM SUFFOCATION.—On Saturday evening last a young man named L. D. Mapes reached this city from Texas, for the purpose of attending school at Eastman College. He put up at the Morgan House for the night, being assigned to room No. 70. He retired to bed about 11 o'clock, and being wholly unacquainted with the use of gas, when he got ready to go to bed he blew it out. Nothing more was heard from him until 11 o'clock Sunday morning, when, the man not making his appearance, the door of his room was forced open, and the occupant was found lying on the floor by the door in an unconscious manner. As soon as possible Dr. Stevenson, who resides at the Morgan House, was summoned, and in a short time he succeeded in restoring Mr. Mapes to consciousness, and he gradually recovered during the evening, when he was able to be about. His escape from death is considered almost miraculous. In some manner during the night he had rolled off the bed upon the floor, to the edge of the door, where it is supposed he succeded in getting a little fresh air, which, no doubt, was the means of saving his life. Mr. Mapes was wholly unacquainted with the use of gas. He says he noticed it frequently at railway stations and other places during the trip here, but had no idea of its workings. He has propably found out by this time."

I deem this case a very important one, because it is evidence which mere experiments cannot equal, and no person would voluntarily furnish.

The Morgan House, located on Main street, is a large, well-built brick building, and the fact that it is "supposed" the young man got a little fresh air by rolling to the edge of the door shows that he lodged in a close room, and that a little fresh air was the means of saving his life.

I am informed that the room is 12 feet in length, 10 feet in width, and 9½ feet in height, and the light which he blew out was from a 4-foot burner. We find, therefore, that Mr. Mapes lay for 12 hours inhaling that gas, and when found was unconscious. Yet in a short time he was restored to consciousness, and in a few hours he was able to be about again. And this gas which he inhaled, was made by the Citizens' Gas Company of Poughkeepsie, under the Allen-Harris Process—an illuminating water gas, pure and simple, without any dilution or modification by air, coal gas, or other mixture.

I am just informed that Mr. Mapes is now about his business, and feeling no effects from "blowing out the gas."

Another case occurred about a year ago at the Northern Hotel, in the same city, which was supplied by the same company's gas. Two plain old men from the country slept in room 26, on the third floor. In the morning there was a strong smell of gas in the hall, and the landlord was informed of it. Upon opening their room it was found that the stop-cock to a 5-foot burner was fully one-half open. The room was 10 by 12 feet, and 7½ feet high. The men, on going to bed, had blown out the light, left the gas escaping all night, and when the discovery was made they were found in the dining room *quietly eating their breakfast.* H. P. ALLEN.

New York, Jan. 7, 1880.

Sudden Death.—On Sunday, Sarah Corkran, a domestic employed at No. 55 West Twelfth street, blew out the gas in her room when she went to bed. Next morning she was found insensible.. She died yesterday in the New York Hospital.—*N. Y. Times*, Jan. 23.

[This was not coal gas.—ED.]

Brooklyn Electric Light Company.

The Brooklyn Electric Light Company filed its annual report in the office of the County Clerk. The capital stock of the company is put at $2,500,000, divided into 25,000 shares of $100 each. The report states that on the 1st of December, 1878, ten shares were subscribed and paid up Jan. 13, 1880. On Jan. 11 the remaining shares of the capital stock, amounting to 24,900 shares, were issued in payment for certain licensed rights relating to a number of patent rights for illumination by electricity. The report is signed by Geo. A. Boynton, President, and N. A. Boynton, Andrew W. Kent, Charles E. Ford, and Albert A. Downing, Trustees.—*N. Y. Sun.*

Price of Gas Reduced in Pontiac, Mich.

To the Public:—With a view to induce a larger consumption of coal gas by the citizens of Pontiac, thereby benefiting the consumer, and, by the increased sale, the manufacturer, it is now proposed to offer to the public a large reduction in the price heretofore charged.

In order to accomplish this desirable object without loss to the owners of the works, it is necessary to obtain the co-operation of the inhabitants of the city, in returning to a more liberal and free use of gas, as in the change of price proposed consumers will share in the benefits, and can afford to use it more freely.

The general price heretofore has been $3.25 per 1000 cubic feet, with a discount of 25 cents per 1000 feet for prompt payment. It is now proposed to reduce the price to $3 per 1000 feet, with a further reduction of 50 cents per 1000 feet, on condition only that payment shall be made at the office of the company on or before the tenth day of the month following, to take effect after the first of January next. This rule will require to be rigidly enforced, and, with the large inducements offered, no one should be displeased or unwilling to comply with it.

The purchase of coal and the payment for labor demand cash, and cannot be procured without it. A consumer who defers payment from two to six months is no benefit to the works. The introduction of a more prompt paying system will be a mutual benefit to all concerned.

There is no city in the United States, with a population not exceeding that of Pontiac, that is furnished with coal gas as cheap as it is now furnished in Pontiac.

In reducing the price to prompt paying consumers to the low figure of $2 50 per 1000 cubic feet, it is accorded to all alike—the poor, who need it most, and the rich, who consume gas in large quantities. They are all offered the opportunity to enjoy the benefits, whether burning it in large or small quantities. We appeal, therefore to the citizens of Pontiac to examine this proposition. If they think gas companies are making large profits, we will show them that it is not so here. If they want stock, we will sell it to them at par, and it has never been watered. By the hearty encouragement of your citizens, we hope to make it a reasonably compensating investment. ALLEN A. RABINEAU, Manager.

—*Pontiac (Mich.) Exchange*, Dec. 10.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)

24 Pine Street, New York City.

February 2, 1880.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid.	Asked.
Gas Co.'s of N. Y. City.				
Central	466,000	50	45	55
Harlem	1,800,000	50	40	45
" Bonds	170,000			103
Manhattan	4,000,000	50	150	160
Metropolitan	2,500,000	100	118	122
" Scrip	$1,000,000	...	95	100
Mutual	5,000,000	100	50	55
" Bonds, gold	900,000	1000	95	100
Municipal	1,500,000	100	135	145
" Bonds	750,000		106	110
New York	4,000,000	100	88	92
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	110	120
Citizens	1,200,000	20	50	55
" S. F. Bonds.	320,000	1000	100	10½
Peoples	1,000,000	10	25	35
" Bonds	325,000	...	--	95
" Scrip	300,000	...	75	80
Metropolitan	1,000,000	100	60	70
Nassau	1,000,000	25	50	60
" Ctfs.	700,000	1000	80	85
Williamsburgh	1,000,000	50	65	75
" Scrip		...	90	95
Kings Co	135,000	100	—	50
" Bonds	40,000	—	—	—
Union Co. E. N. Y.		25	—	50
Richmond Co., S. I.	300,000	...	—	85
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N.Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md.	2,000,000	100	95	98
" Ctfs., gold	1,000,000		—	103
Bayonne, N. J.		100		90
Brockport, N. Y.	25,000	100	...	80
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			132	—
Cincinnati G. & C. Co.				190
Derby of Conn.	160,000	100	60	80
East Boston, Mass.		25	114	120
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind.		100	...	—
Hannibal, Mo.	100,000	100	95	100
Hartford, Conn.	700,000	25	120	125
Hempstead, L. I.	25,000	100	...	—
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
Jersey City	750,000	20	140	145
Jamaica, L. I.	25,000	100	...	—
Jacksonville, Ill.	120,000	50	100	...
Lewistown Maine	400,000	100	70	80
Laclede St Louis Mo.	1,200,000	100	100	105
Long Branch		20	30	40
New Haven, Conn.		25	120	140
Peoples, Jersey City		...	40	50
" " Bds.				95
Peoples of Albany	650,000	100	—	10
" Bonds	350,000	1000	--	-
Peoples of Baltimore		25	60	65
" Bonds			106	—

F. O. NORTON,

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Hydraulic Cement,

Specially adapted for gas works. Under water it is capable of giving better results than Portland or any other cement.

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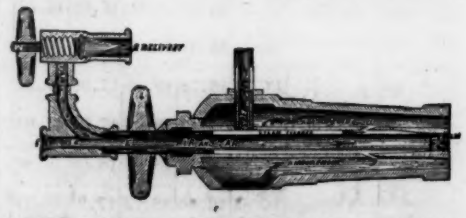

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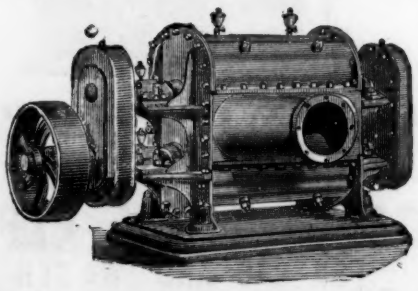

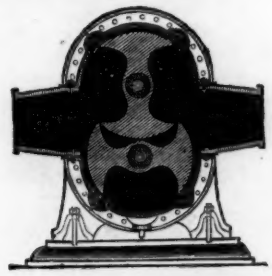

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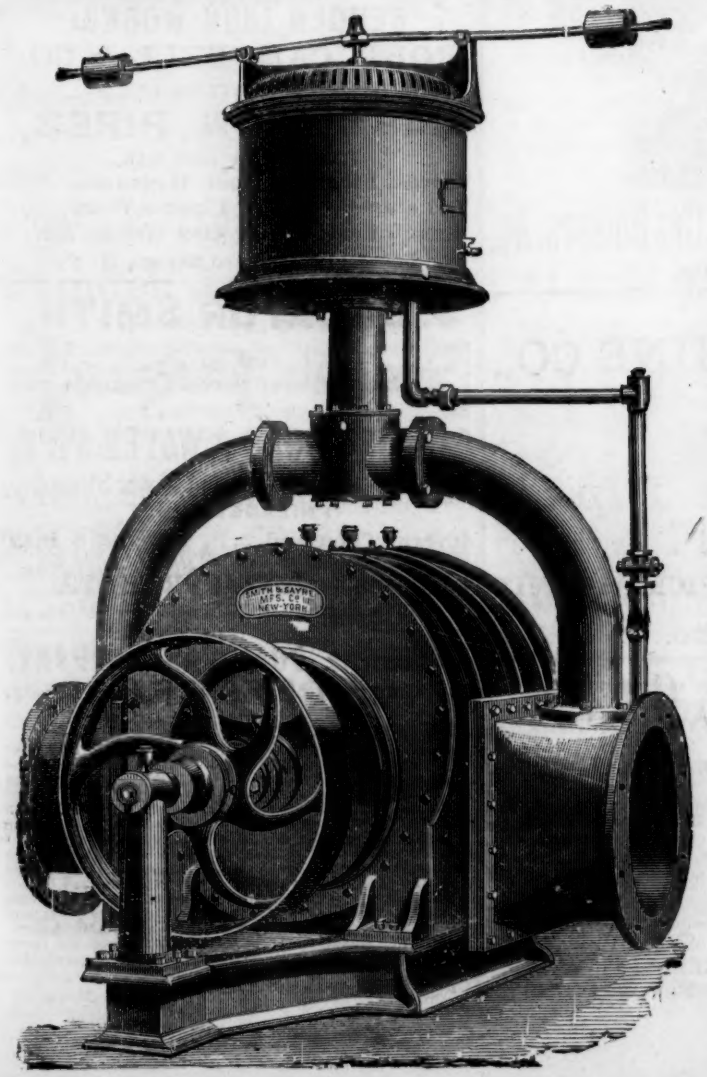

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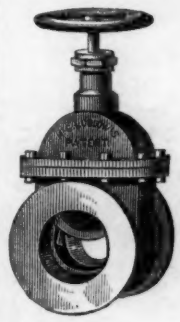

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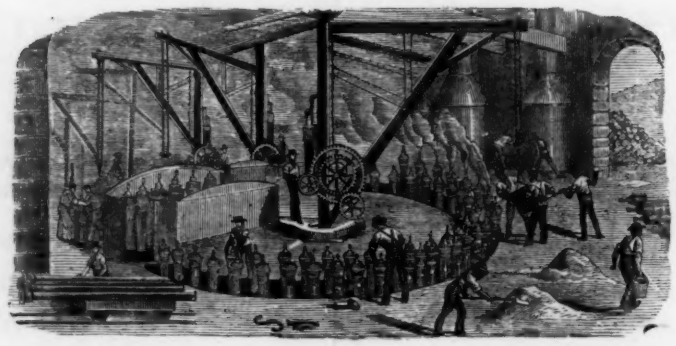

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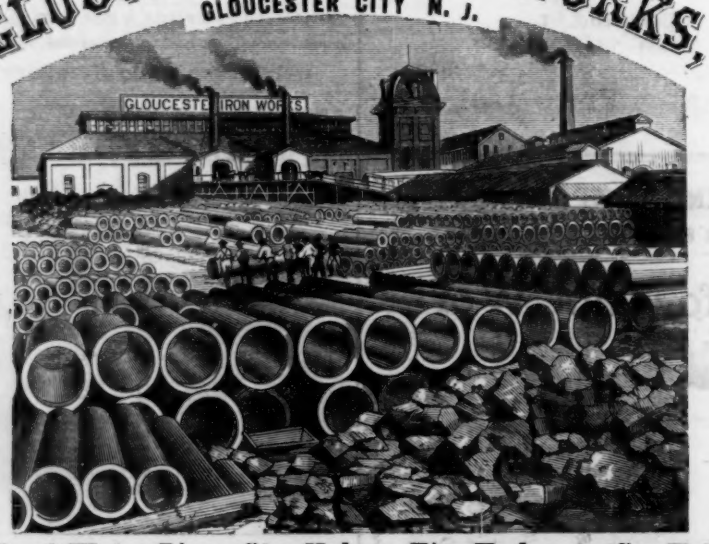

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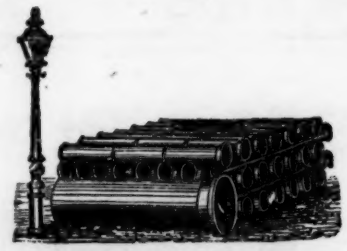

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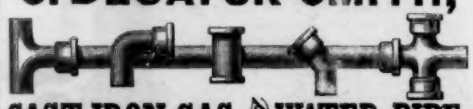

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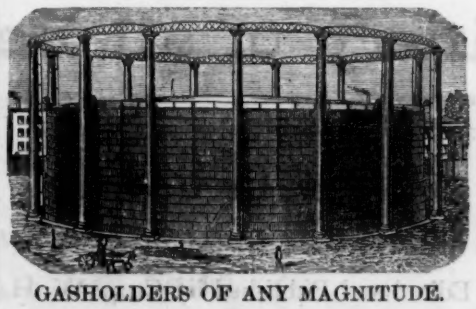

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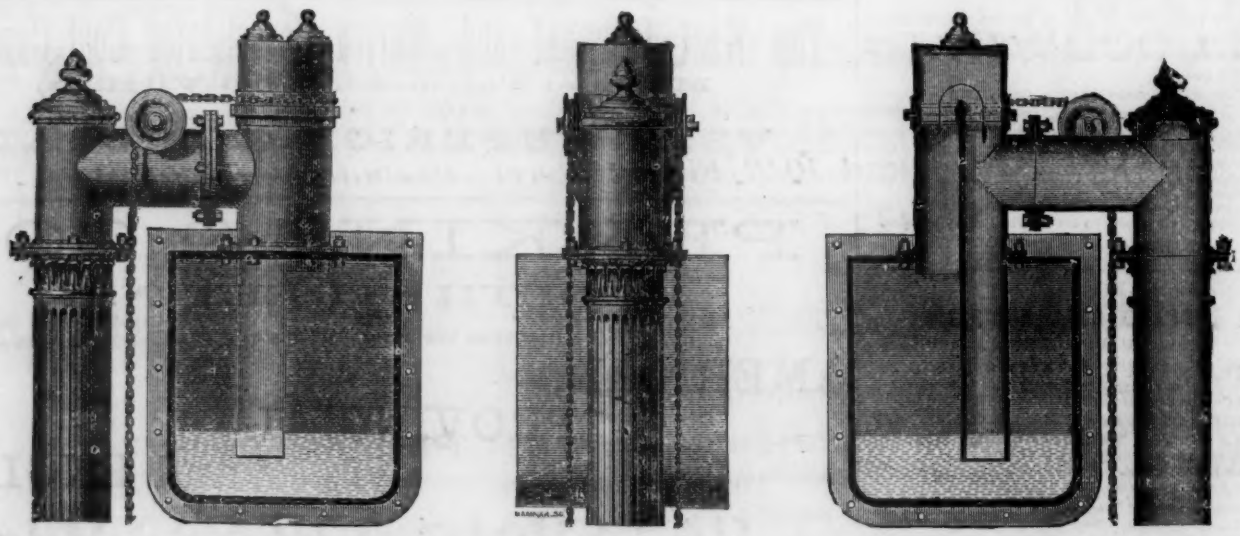

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